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The Polytechnic, Sports Development, and Student Development: A Pathway to Holistic Growth

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Abstract

Polytechnic education plays a critical role in national development by bridging the gap between theoretical knowledge and practical skills acquisition. However, various challenges, such as inadequate funding, policy implementation gaps, and limited extracurricular engagement, continue to hinder the effectiveness of polytechnic institutions in Nigeria. This study examines the impact of polytechnic education on workforce readiness, the role of extracurricular activities in enhancing student performance, and the significance of sports participation in fostering leadership, teamwork, and mental well-being. Drawing from scholarly works, the study highlights the need for policy reforms to address barriers to sports development, improve technical and vocational education, and integrate structured extracurricular programs to enhance student engagement and cognitive performance. Additionally, findings from neuroscience and sport psychology suggest that physical activity positively influences stress resilience, cognitive function, and academic success among students. The study recommends amongst others that Nigerian polytechnics adopt evidence-based strategies to enhance student development, including increasing investments in sports infrastructure, promoting industry-focused training, and fostering an active learning environment that supports both academic and extracurricular excellence.

Keywords: polytechnic education, workforce readiness, extracurricular activities, student performance, sports participation, student development, sport development

1. Introduction

Polytechnics function as educational institutions that deliver technical and vocational training which prepares students with practical skills needed for the job market according to UNESCO (2022). Polytechnics prioritize teaching technical

skills in engineering and business yet they support student development through extracurricular activities like sports (Adebayo & Okon, 2021). Polytechnic sports programs develop character, teamwork abilities, discipline, and leadership skills that students need to succeed both personally and professionally

(Chatterjee, 2020). Research indicates that taking part in sports activities results in substantial improvements in students' cognitive growth and mental toughness. Research has also demonstrated that physical activity leads to better brain performance while also increasing focus and developing problem-solving abilities (Ratey & Loehr, 2019). Recent studies have also shown that sports participation decreases anxiety and depression levels which aids students in managing academic stress (Gerber et al., 2018). The intense academic and technical training at polytechnics demands students maintain sustained focus and perseverance (Obasi & Eze, 2020).

Sports activities provide multiple psychological and cognitive advantages while supporting students' total wellness. The World Health Organization [WHO] (2021) demonstrates how participating in sports strengthens cardiovascular health while boosting physical fitness and decreasing risks for diseases like obesity and hypertension. Studies shows that sports participation teaches students essential life skills including goal-setting as well as time management and conflict resolution which apply to academic and professional environments (Bailey et al., 2013).

Student development through sports receives significant support from polytechnic institutions. Universities possess well-established sports programs while polytechnics face challenges with insufficient sports facilities and financial support according to Ogunleye (2019). Research indicates that polytechnic students who take part in structured sports activities show academic improvement along with increased social integration and career preparedness according to Adeyemi & Olalekan (2022). It is on this background that this study intends to find out the polytechnic, sports development, and student development: A pathway to holistic growth.

2. The Role of Polytechnics in Education and Skill Development

Polytechnics function as essential higher education establishments that train students to develop practical and technical abilities required for careers and business ventures (UNESCO, 2022). Polytechnics provide competency-based education programs which prepare students to meet industry demands by bridging theoretical knowledge from academia with practical

real-world applications (Okoro & Nwankwo, 2021). The focus of polytechnic curricula on engineering and technology programs, as well as business and other applied sciences serves to strengthen these institutions' contribution to both economic development and technological progress (Ogunleye, 2020). As more skilled workers are needed in the global economy polytechnics play a crucial role in meeting labor market demands while helping to reduce unemployment and support industrial development (World Bank, 2021).

Polytechnic education stands out because it prioritizes experiential learning methods. Students develop technical abilities through practical training in industry environments and laboratory exercises which helps increase their job prospects (Adeyemi & Oladipo, 2021). Skill-based learning in technical and vocational education and training (TVET) stands out as a global trend that supports economic advancement and stimulates innovative progress according to the International Labour Organization [ILO] (2021). Strong TVET systems in countries like Germany and Finland showcase the economic benefits and workforce preparation advantages of polytechnic education through its production of job-ready graduates (European Commission, 2020). Studies indicate that polytechnic graduates display greater adaptability to industry demands than university graduates because their training focuses on practical problem-solving across multiple sectors (Umar & Abubakar, 2020).

Polytechnic education demonstrates considerable strengths yet heavily emphasizes technical training which limits student development in critical areas like sports and physical activities. Polytechnics implement sports programs as part of student life but these programs frequently suffer from insufficient funding and low utilization which leads to restricted participation (Adebayo & Okon, 2021). According to Gerber et al. (2018), introducing sports into polytechnic education improves cognitive development and stress management while developing teamwork and leadership skills essential for professional achievement. Research shows that sports participation helps students develop social skills while enhancing their emotional intelligence and problem-solving capabilities which employers now seek (Bailey et al., 2013).

Educators now increasingly understand that extracurricular activities together with sports form essential components of a comprehensive education which supports holistic development in students (Bailey et al., 2013). The findings from Ratey and Loehr (2019) demonstrate that students who maintain regular physical activity routines achieve enhanced focus levels together with superior time management abilities and demonstrate more resilience when dealing with academic and professional obstacles. Many polytechnic institutions fail to prioritize sports which results in students remaining unaware of its advantages thus decreasing participation rates (Ogunleye, 2019). Students avoid physical activities because of missing structured sports policies and insufficient facilities which negatively impacts their well-being and productivity (Chatterjee, 2020).

With education placing more emphasis on mental and physical wellness polytechnics need to broaden their educational approach to incorporate structured sports activities. Successful integration of sports into academic settings produces skilled professionals while fostering resilience and discipline alongside teamwork abilities for personal and career success (Adeyemi & Olalekan, 2022). Polytechnics need to devise strategies that foster student participation in sports activities while improving their sports facilities and promoting physical fitness values together with technical proficiency. Polytechnics can nurture graduates who excel in their fields and possess essential physical and mental qualities that enable them to succeed in today's fast-changing world.

3. Sports Development in Polytechnics

Sports development involves the establishment of structured programs, provision of adequate facilities, and implementation of policies that promote active participation in athletics and recreational activities (Bailey et al., 2013). Despite the technical focus of polytechnics, integrating sports into student life enhances cognitive, psychological, and social development, reinforcing the importance of a well-rounded education (Gerber et al., 2018).

4. Infrastructural Development

Adequate sports facilities availability is crucial for developing effective sports programs at polytechnic institutions. Well-maintained sports infrastructure in institutions increases student physical activity participation which results in

better physical and mental health outcomes as reported by WHO (2021). Football fields and basketball courts along with gymnasiums and multipurpose sports halls allow students to participate in both competitive and leisure sports activities according to Chatterjee's findings (2020).

Many polytechnics in developing nations face inadequate sports infrastructure because they experience both limited funding and lack of priority in this area (Ogunleye, 2019). Sports participation levels among students have declined and athletic talent development at these institutions faces obstacles. The solution to this problem lies within enhanced funding for sports facilities and strategic alliances with private entities alongside government infrastructure support (Adeyemi & Olalekan, 2022).

5. Policy Implementation

The advancement of sports programs in polytechnics depends on creating and enacting policies that embed sports activities within the educational curriculum. Higher education institutions around the world have put in place programs to promote student involvement in sports because they understand physical activities contribute to better academic results and stronger mental health (Ratey & Loehr, 2019).

Several Nigerian polytechnics now offer mandatory physical education courses alongside athletic programs to boost student involvement (Obasi & Eze, 2020). The full realization of these initiatives has been hindered by inconsistent policy implementation together with insufficient funding and weak enforcement mechanisms (Ogunleye, 2019). To maximize student benefits policymakers need to develop well-structured sports policies with sufficient funding and proper implementation mechanisms.

6. Competitive and Recreational Sports

Sports development in polytechnics fundamentally relies upon the promotion of student involvement in both competitive and recreational sports. Student-athletes have the chance to perform their skills and achieve national and international exposure through competitive sports like inter-polytechnic tournaments and national student games (Adebayo & Okon, 2021). These competitions develop essential skills like teamwork, discipline and leadership which benefit both academic and

professional pursuits according to Chatterjee (2020).

Recreational sports programs aim to include as many students as possible in physical activities by providing opportunities to play sports for enjoyment and fitness instead of competing (Bailey et al., 2013). Research demonstrates that students participating in regular recreational sports achieve reduced stress levels and better cognitive functioning along with enhanced motivation for academic tasks (Gerber et al., 2018). Polytechnics need to implement structured recreational sports programs which provide benefits to students who choose physical activity for wellness rather than competitive sports.

7. Coaching and Training Programs

Professional coaching and training programs serve as fundamental components for student-athletes to develop effectively in polytechnic environments. Structured coaching programs enable student athletes to enhance their abilities while boosting performance levels and preparing for competitive events (Adeyemi & Olalekan, 2022). Experienced coaches provide mentorship that builds student-athletes' resilience and motivation while helping them establish goals leading to better sports performance and academic outcomes according to Ratey & Loehr (2019).

Multiple polytechnics experience difficulties due to shortages of certified sports trainers and insufficient training infrastructure (Ogunleye, 2019). To solve this problem we need partnerships between sports organizations, government agencies, and private investors to deliver professional coaching services and student training opportunities. Structured mentorship programs and workshops will provide additional support to student-athletes so they can maintain a balance between their sports participation and academic responsibilities (Obasi & Eze, 2020).

8. The Impact of Sports on Student Development

Sports play a pivotal role in shaping students' overall development by enhancing physical, mental, academic, and social competencies. While polytechnics primarily focus on technical and vocational training, integrating sports into student life provides numerous benefits that extend beyond the classroom (Bailey et al., 2013). Research suggests that students engaged

in regular sports activities experience improved health, better academic performance, stronger leadership qualities, and enhanced social integration (Gerber et al., 2018).

8.1 Physical and Mental Well-Being

Participation in sports significantly contributes to students' physical and mental well-being. Regular physical activity improves cardiovascular health, muscular strength, and overall fitness levels, reducing the risk of chronic illnesses such as obesity, diabetes, and hypertension (World Health Organization [WHO], 2021). Additionally, exercise has been proven to alleviate stress, anxiety, and depression by stimulating the release of endorphins—hormones that promote feelings of happiness and relaxation (Ratey & Loehr, 2019).

Engaging in sports also enhances cognitive function by improving concentration, memory, and problem-solving skills (Donnelly et al., 2016). A study by Gerber et al. (2018) found that university students who participated in regular physical activities reported lower levels of psychological distress and higher academic motivation compared to their non-active peers. Thus, polytechnics that integrate sports into their student development programs contribute to both the mental stability and academic success of their students.

8.2 Academic Performance

There is a common misconception that sports distract students from their academic responsibilities. However, research indicates that physically active students tend to perform better academically due to improved cognitive function, discipline, and time management skills (Singh et al., 2019). Studies have shown that physical activity enhances brain function by increasing blood flow to the brain, which boosts memory retention and learning capacity (Donnelly et al., 2016).

Moreover, student-athletes often develop strong time management skills as they must balance training schedules with academic commitments. A study by Adebayo and Okon (2021) found that students involved in structured sports programs exhibited better organizational skills and higher levels of concentration in academic tasks. These findings highlight the importance of maintaining a balance between sports and academics in polytechnics to optimize student development.

8.3 Leadership and Teamwork

Sports provide students with valuable opportunities to develop leadership skills, teamwork, and a sense of responsibility. Participation in team sports fosters communication, cooperation, and problem-solving abilities, which are essential skills in professional and social settings (Chatterjee, 2020). Leadership roles, such as team captains or sports club coordinators, help students cultivate confidence, decision-making abilities, and resilience in competitive environments (Adeyemi & Olalekan, 2022).

Research by Bailey et al. (2013) suggests that student-athletes are more likely to exhibit strong leadership and interpersonal skills, which contribute to their career success. These attributes are particularly beneficial in polytechnic settings, where students are expected to transition into the workforce with both technical and soft skills.

8.4 Career and Skill Development

Engaging in sports can open various career pathways for students beyond their chosen academic disciplines. Many students who participate in polytechnic sports programs explore careers in coaching, sports management, athletic training, and fitness instruction (Duda & Appleton, 2016). Furthermore, professional sports organizations often recruit talented athletes from polytechnics, providing them with opportunities to advance into competitive sports careers (Obasi & Eze, 2020). In addition to career prospects, sports enhance students' employability by equipping them with essential soft skills such as discipline, perseverance, and strategic thinking (Adebayo & Okon, 2021). These attributes make student-athletes more competitive in the job market, regardless of their field of study.

8.5 Social Integration and Networking

Sports enable social unification among students at polytechnic institutions through team participation which builds community bonds. Team sports enable students from different backgrounds to interact with each other which helps in building cultural understanding and inclusivity (Chatterjee, 2020). Ogunleye's 2019 study demonstrates that colleges with active sports programs see enhanced student involvement and fewer instances of social isolation.

Students who participate in sports gain valuable networking possibilities that support their educational and professional development. Students who participate in inter-polytechnic sports competitions establish important connections with their peers as well as mentors and industry professionals which creates opportunities for future collaborative work and career opportunities (Adeyemi & Olalekan, 2022). Sports integration within polytechnic education serves as a fundamental element for student development because it supports physical health and mental well-being while also enhancing academic excellence, leadership skills, career opportunities and social inclusion. By establishing sports programs as a priority institution create an educational environment that equips students for success in their professional lives as well as personal growth. Polytechnics need to allocate resources towards sports development initiatives to help students experience complete benefits from physical activities while they continue their academic studies.

9. Challenges Facing Sports Development in Polytechnics

Despite the numerous benefits of sports in fostering student development, its implementation in polytechnics faces several challenges. These barriers hinder student participation, limit the effectiveness of sports programs, and reduce the overall impact of sports on physical and mental well-being. Key challenges include inadequate funding, lack of institutional support, time constraints, and poor awareness and motivation.

9.1 Inadequate Funding

One of the primary challenges facing sports development in polytechnics is inadequate funding. Limited financial resources hinder the development and maintenance of sports facilities, the recruitment of qualified coaches, and the organization of competitive events (Ogunleye, 2019). Many polytechnics operate on tight budgets that prioritize academic and technical programs, often leaving sports programs underfunded or neglected (Adebayo & Okon, 2021).

According to Omoruan (2018), the lack of financial investment in sports infrastructure results in poorly maintained facilities, inadequate equipment, and restricted access to training programs. This financial constraint

discourages student participation in sports and limits the potential benefits of sports development in polytechnics.

9.2 Lack of Institutional Support

Institutional policies and administrative attitudes significantly impact the development of sports programs. In some polytechnics, sports are not considered an essential aspect of student development, leading to minimal institutional support (Adeyemi & Olalekan, 2022). Without active encouragement from school management, sports facilities may be neglected, sports programs may lack proper organization, and students may not be motivated to participate in extracurricular athletics.

A study by Ogunleye (2019) found that polytechnics with strong institutional support for sports had higher student participation rates, better infrastructure, and improved academic performance among student-athletes. Conversely, institutions that overlooked sports experienced low engagement levels, which negatively impacted student well-being. This suggests that management commitment to sports policies is crucial for fostering an active and healthy student population.

9.3 Time Constraints

The rigorous academic schedules of polytechnics often leave little time for students to engage in sports activities. Polytechnic curricula are structured to emphasize practical training and skill acquisition, leading to demanding coursework, laboratory sessions, and industrial training (Adebayo & Okon, 2021). As a result, students struggle to balance academic commitments with sports participation.

Research by Singh et al. (2019) indicates that students in technical education programs often experience high academic pressure, which reduces their willingness to engage in extracurricular activities such as sports. Furthermore, many polytechnics do not integrate sports into their academic schedules, making it difficult for students to dedicate time to physical activities without compromising their studies.

To address this challenge, institutions should adopt flexible academic schedules that allow students to engage in sports without negatively impacting their coursework. Establishing mandatory physical education programs or

designated sports periods could also encourage student participation (Chatterjee, 2020).

9.4 Poor Awareness and Motivation

A lack of awareness regarding the benefits of sports and low motivation among students further hinder sports development in polytechnics. Many students perceive sports as secondary to their academic and career aspirations, failing to recognize its role in enhancing physical health, mental well-being, and career prospects (Gerber et al., 2018).

Moreover, societal attitudes often emphasize technical skills and academic success over extracurricular engagement, discouraging students from actively participating in sports (Omoruan, 2018). Some students may also lack self-confidence in their athletic abilities or feel intimidated by competitive sports environments, leading to low participation rates.

According to Duda and Appleton (2016), increasing student awareness through campaigns, orientation programs, and incentives can help boost participation in sports. Institutions should also create inclusive sports programs that cater to students of all skill levels, making sports participation more accessible and enjoyable.

10. Conclusion

This paper has highlighted the significant role of sports development in polytechnics and its impact on student development. While polytechnics primarily focus on skill acquisition and technical education, integrating sports into student life enhances physical and mental well-being, improves academic performance, and fosters leadership, teamwork, and career development. Sports also promote social integration, providing students with networking opportunities and a sense of belonging. However, the implementation of sports programs in polytechnics faces several challenges, including inadequate funding, lack of institutional support, time constraints, and poor awareness and motivation among students. These challenges hinder student participation and limit the potential benefits of sports in polytechnics.

11. Recommendations

- 1) Polytechnic institutions should increase budget allocations for sports facilities, equipment, and training programs.
- 2) School management should integrate sports

- into academic schedules to encourage student participation.
- 3) Policies promoting mandatory physical education and recreational sports should be implemented.
 - 4) Awareness campaigns should be conducted to educate students on the benefits of sports.
 - 5) Institutions should recruit qualified coaches and sports administrators to enhance sports development.
 - 6) More inter-polytechnic competitions should be organized to motivate student-athletes.
 - 7) Flexible academic structures should be introduced to balance sports and academic commitments.
 - 8) Private and public sector partnerships should be explored to fund sports initiatives in polytechnics.
 - 9) Institutions should create inclusive sports programs catering to students of all skill levels.
 - 10) Research should be conducted to assess and improve the effectiveness of sports programs in polytechnics.

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Research on the Stability of Curling Athletes' Throwing Movements Based on Balance Ability Training

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Abstract

Curling is an ice sport that highly depends on body control and movement accuracy. The stability of the throwing motion directly affects the technical performance and tactical execution in the game. To explore the influence mechanism of balance ability training on the stability of curling players' throwing motions, this study selected the curling team of a certain university as the research subjects and conducted an 8-week balance training intervention experiment. A pretest-posttest control group design was adopted to compare the differences between the experimental group and the control group in key indicators such as the repeatability of the throwing motion, landing point deviation, and posture stability. The research results showed that systematic balance training significantly improved the core control ability and lower limb coordination of the athletes. The experimental group outperformed the control group in terms of the consistency of the landing point, control of the throwing motion amplitude, and maintenance of dynamic posture, and the differences were statistically significant ($p < 0.05$). The study indicates that balance ability is a key physical factor affecting the stability of curling throwing motions, and scientifically designed balance training can effectively enhance the accuracy and stability of curling-specific technical movements. This paper provides theoretical basis and practical guidance for the optimization of curling-specific physical training.

Keywords: balance ability training, curling, throwing motion, technical stability

1. Introduction

Curling is a winter Olympic event that integrates precision, strategy, and teamwork. The stability of the throwing motion, its core technique, plays a decisive role in the

competition. During the throwing process, athletes need to maintain body stability, precise trajectory control, and continuous balance in a series of fine movements such as sliding, pushing off, squatting, and releasing the stone.

Therefore, the quality of their movements not only depends on their technical proficiency but also highly relies on their body control ability and dynamic balance ability.

In recent years, with the popularization of curling in colleges and professional training systems, the technical training of athletes has gradually become systematic. However, in actual training, it is often found that athletes have problems such as large release tremors, body center of gravity shifts, and inconsistent landing points when performing the throwing motion. These problems are not merely due to technical inexperience but are closely related to weak core strength, poor lower limb stability, and insufficient body control ability of the athletes. Existing research has pointed out that balance ability has a significant impact on precise movement control, injury prevention, and competitive performance in ice and snow sports, especially in sports that mainly involve single-leg support and lower limb force application.

In response to this issue, some training practices have begun to introduce balance training methods (such as core training, dynamic stability exercises, perception-motor coordination training, etc.) into curling-specific training in recent years. However, systematic and quantitative research is still scarce, especially lacking empirical studies that take the stability of the throwing motion as the core indicator and combine balance ability training intervention. Therefore, it is urgently necessary to scientifically design experiments to verify the actual effect of balance training on the technical performance of curling and further explore its mechanism of action and training path.

2. Research Background

Curling, as an ice sport that combines competitiveness with precise control requirements, has the stability of its technical movements playing a decisive role in the outcome of the game. Particularly in the throwing phase, athletes need to complete precise release and rotation control while in a dynamic sliding state, which places extremely high demands on lower limb strength, core control, and body balance ability (Zhao & Lin, 2021). Compared with other winter sports, the integrated movement characteristics of curling during the throwing process, namely “single-leg support—control sliding—low-level force

application—precise landing”, make body balance ability a key foundation for achieving technical stability.

With the in-depth implementation of the strategy to “get three hundred million people involved in winter sports”, the development of curling in Chinese universities has been rapid, and the coverage of teaching and training has been continuously expanding. However, in the training system, the integration of specific physical fitness and technical training remains relatively low. Many grassroots coaches still focus mainly on repetitive throwing and trajectory adjustment, neglecting the specialized training of athletes’ dynamic control ability and posture stability. This has led to problems such as unstable movements, inaccurate landing points, and uneven throwing force among students during competitions (Liu et al., 2022). This phenomenon reveals the insufficiency of the current curling teaching system in terms of training scientificity and physical fitness structure design.

Several studies have confirmed that balance ability training in ice sports such as skiing, skating, and figure skating can effectively enhance athletes’ dynamic posture control and body coordination, making it a core element for improving the stability of specific movements (Park et al., 2020; Zhang & Sun, 2023). Especially in sports with high requirements for movement precision and complex body control, the improvement of core stability and body balance can significantly reduce movement fluctuations and lower the rate of technical errors (Huang et al., 2021). However, in the field of curling, empirical research on systematically introducing balance training for specific movement intervention is still scarce, theoretical support is insufficient, and standardized intervention models are lacking.

In response to the “technical instability” problem in curling throwing movements, starting from balance ability training can not only make up for the deficiencies in existing curling training methods but also promote the development of curling specialized training towards a multi-dimensional integration of “technique—physical fitness—control”. The proposal of this study is based on filling this research and training gap, attempting to explore a scientifically feasible balance training path and systematically evaluate its practical effectiveness in terms of technical stability.

3. Research Questions

3.1 Construction of the Comprehensive Evaluation Index System for the Stability of Ice Hockey Throw Movements

Currently, the evaluation of the stability of ice hockey throws is fragmented, and common indicators (such as landing deviation, throwing speed) lack unified weights. A scientific index system should be constructed from three dimensions: kinematic consistency (release point coordinates, trajectory mean square error), dynamic smoothness (variance coefficient of lower limb support force curve), and movement sequence (synchronization of gliding and release rhythm). Quantification can be achieved through high-frame-rate motion capture and the combination of ground reaction plates. Previous studies have reported that the mean square error of trajectory can sensitively reflect technical fluctuations, providing a basis for indicator selection.

3.2 The Mechanism of the Effect of Balance Training on Improving Technical Stability

Balance training can enhance vestibular-proprioceptive integration and core muscle group coordination, reduce the lateral sway of the center of gravity during the throw, and thereby improve trajectory consistency. The meta-analysis of neuromuscular training on dynamic balance shows that training can significantly increase the duration of single-leg support and the area of the stability domain, suggesting that the feedforward-feedback control loop is strengthened (sciencedirect.com). It is necessary to clarify: whether the change in the activation sequence of the core and lower limb muscles mediates the improvement in technical stability; the coupling strength between the time constant of posture adjustment and technical and tactical performance after training.

3.3 Integration and Practice of Balance Training Programs and Ice Hockey Specialized Technical Training

How to incorporate balance training modules (such as BOSU dynamic support, single-leg sliding pad, etc.) into the throw hockey technique class to form a closed loop of “warm-up-specialized balance-technique execution-immediate feedback” is a practical difficulty. Recent 9-week balance training intervention by a skiing coach indicates that “preliminary balance + immediate visual

feedback” can accelerate the internalization of techniques. This study needs to design intervention models with different embedding timing, frequency, and intensity to compare their differential effects on classroom efficiency and movement stability.

3.4 Interaction Between Balance Training Load and Technical Training Intensity

Excessive balance training load (frequency × difficulty) may cause fatigue and weaken the quality of the technical class; too low a load is difficult to induce adaptation. It is necessary to explore the interaction effect of load and technical intensity: the influence of different balance loads on the slope of the learning curve of technical skills; whether inappropriate matching of load and intensity causes fluctuations and rebounds in movements. The latest visual-balance intervention study for elite ice hockey players has proved that medium-high-load intervention can significantly improve speed control and throwing accuracy within 4 weeks.

4. Research Objectives

This study aims to explore the effect and mechanism of introducing systematic balance ability training intervention on the stability of ice hockey players’ throwing movements, with the expectation of providing theoretical basis and practical approaches for the integration of physical fitness and technique in ice hockey training. The specific goals are as follows:

Establish a scientific evaluation system for the stability of ice hockey throwing movements

Starting from multiple dimensions such as technical execution, action consistency, and dynamic posture control, develop a quantifiable and repeatable evaluation index system for the stability of throwing movements, providing a foundation for subsequent empirical analysis and training effect evaluation.

Exploring the intervention effect of balance ability training on technical stability

By comparing the performance differences in juggling before and after training between the experimental group and the control group, systematically evaluate the degree of influence of balance training on key technical indicators such as trajectory consistency, landing error, and movement stability.

Revealing the mechanism of balance training in improving technical stability

Combining dynamic balance ability, core control ability and movement performance data, analyze the impact path of balance training on juggling techniques in aspects such as action control, muscle group coordination, and posture adjustment.

Designing a balance ability training model suitable for ice hockey training

Developing a well-structured, scientifically designed, and operationally feasible balance training program, clearly defining its training cycle, load arrangement, and embedding method for technical lessons, to provide model references for the optimization of training systems in universities or professional ice hockey teams.

Providing empirical support for the scientification of ice hockey specific physical training

Promoting the transformation of ice hockey teaching and training from a “heavy on techniques, light on physical fitness” model to a “technique and physical fitness integration” model, strengthening the supporting role of specific physical fitness in improving technical quality and competition performance.

5. Significance of the Research

5.1 Theoretical Significance

Enrich the theoretical framework of ice hockey training

Current research on ice hockey training mainly focuses on technical movement analysis, tactical collaboration, and psychological training. Systematic research on the role of “physique—technique integration”, especially balance ability, is relatively weak (Liu et al., 2022). This study takes balance training as the entry point, constructs a “balance—control—stability” mechanism model, which is helpful to expand the theoretical research path for the stability of ice hockey athletes’ specialized skills.

Deepen the understanding of the physical intervention mechanism in ice sports

Completing high-precision technical movements in dynamic environments is a common feature of winter sports. Existing studies have confirmed that balance training has a significant promoting effect on the stability of movements and lower limb control abilities in skiing, skating, and other projects (Huang et al., 2021;

Zhang & Sun, 2023). This study empirically verifies this mechanism in the ice hockey project, fills the research gap on the relationship between ice hockey physical training and the accuracy of throwing actions, and further improves the theoretical basis of physical intervention in winter sports.

5.2 Practical Significance

Optimize the teaching and training system of ice hockey in universities

The teaching resources of ice hockey in universities are limited. Traditional training mainly consists of repetitive throwing and technical imitation, lacking specialized physical support, and the improvement of technical stability is slow (Liu et al., 2022). The balance training plan developed in this study is low in cost and highly effective, and is convenient for promotion in university classrooms, which is helpful to improve teaching effectiveness and student competitive performance.

Enhance the technical precision of athletes’ specialized movements

The stability of technical movements directly affects the control quality of the puck and the success rate of tactical execution in ice hockey competitions. This study can establish a long-term and sustainable physical training support path for ice hockey athletes, enhance their control force and consistency, thereby reducing the error rate in competitions and improving competitive levels.

Provide a model for the cross-project promotion of physical training in ice sports

The research experience of the ice hockey project can be replicated to other high-precision ice sports, such as short track speed skating and figure skating. The methods and intervention models of this study can provide practical references for coaches and physical trainers of related projects, promoting the scientific and systematic nature of ice sports training.

6. Research Methods

This study employed an experimental approach combined with questionnaires and movement performance analysis methods. Through an 8-week balance ability training intervention for curlers, the study aimed to evaluate the impact and mechanism on the stability of their throwing actions. The specific research methods are as follows:

6.1 Research Design

A pre-test-post-test control group design was adopted in the quasi-experimental design.

The experimental group received both ice hockey basic skills training and balance ability training;

The control group only received regular ice hockey training.

6.2 Research Subjects

Research Subjects: A total of 24 members of the university curling team from Changchun Tourism University were selected. Their average age ranged from 18 to 22 years old, and they had more than one year of specialized training experience in curling.

Grouping Method: Randomly divided into the experimental group (n=12) and the control group (n=12). Gender, age, and athletic level were balanced and matched.

6.3 Intervention Content: Balance Ability Training Program

Training Period: 8 weeks, 3 times a week, 30-45 minutes each time

Content Modules:

Static Core Stability Training (such as plank position, side support)

Dynamic Posture Control (such as single-leg BOSU, sliding mat control, core anti-interference training)

Movement Control and Posture Adjustment Exercises (such as “closed-eye sliding step—single-leg fixed standing”)

Intensity Progression: Adjust the training difficulty and stability interference level every 2 weeks.

6.4 Measurement Indicators and Tools

Table 1.

Dimension	Indicator Name	Measurement Tool/Method
Stability of the throwing motion	Bowling trajectory deviation	High-speed camera + kinematic video analysis system
	Throwing landing point error	Center target coordinate measurement (manual + video assistance)
	Consistency of movements score	Coach's expert rating + Comparison of movement trajectories (RMS error)
Balance ability	Total score of Y balance test	Y-Balance testing device
	Time spent standing on one leg	Timer + video review
Subjective feedback	Learning engagement and technical confidence	Self-compiled Likert scale questionnaire

6.5 Data Analysis Methods

Descriptive statistical analysis: basic distribution analysis such as mean and standard deviation.

Paired sample t-test: comparison of changes in pre- and post-tests within the same group.

Independent sample t-test: comparison of the significance of differences between the experimental group and the control group after intervention.

Multivariate analysis of variance (MANOVA): comparison of overall differences in multiple throwing action indicators.

Correlation analysis: linear relationship between balance ability indicators and action stability indicators.

Qualitative analysis: analysis of interview text to determine the main content of students' feedback on training.

Software used: SPSS 27.0 (quantitative analysis), Excel 365 (charts), NVivo 12 (qualitative analysis).

7. Research Results and Analysis

7.1 Analysis of Changes in Throwing Action Stability Indicators

Bowling trajectory deviation (unit: °/cm)

The experimental group decreased from an average of 6.3° to 3.8°, a decrease of 39.7%;

The control group decreased from 6.5° to 5.9°, a decrease of only 9.2%.

Statistical results: Paired sample t-test showed

significant differences between the experimental group before and after ($p < 0.01$), and significant differences between groups ($p < 0.05$).

Explanation: Balance training significantly improved the control ability of the bowling trajectory.

(1) Bowling landing error (unit: cm)

The experimental group decreased from 28.7 cm to 17.4 cm, while the control group decreased from 29.1 cm to 25.2 cm;

The improvement in the experimental group was significantly greater ($p < 0.01$).

Explanation: Subjects could release the ice puck more accurately after improving their dynamic balance ability.

Action consistency score (expert rating, 10-point scale)

The experimental group increased from an average of 6.2 to 8.1 points; the control group showed no significant change;

MANOVA showed a significant main effect of teaching intervention on action consistency.

Explanation: Improving core control ability helps to improve the repeatability and quality of the throwing action.

7.2 Analysis of Changes in Balance Ability Indicators

Y balance test score (total score 300)

The experimental group increased from 215 to 265; the control group showed little change;

t-test results: The experimental group improved significantly ($p < 0.01$), while the control group had no statistical significance ($p > 0.05$).

Explanation: The balance training program effectively improved dynamic balance control ability.

Single-leg eyes-closed standing time.

The experimental group increased from an average of 12.6 seconds to 21.8 seconds, while the control group showed no significant change;

Explanation: The lower limb stability and anti-interference ability of the experimental group significantly improved.

7.3 Correlation Analysis of Technical Performance and Balance Ability

Table 2.

Indicator relationship	Correlation coefficient r	Significance p
Y balance total score ↔ landing error	-0.71	< 0.01
One-leg standing time ↔ Action consistency score	0.65	< 0.01
Core stability level ↔ Archery trajectory deviation	-0.60	< 0.05

Explanation: There is a moderately significant positive correlation between balance ability and the stability of throwing movements, further verifying the research hypothesis.

7.4 Analysis of Subjective Questionnaires and Interview Feedback (Qualitative)

Student feedback: Most of the students in the experimental group believed that the training improved “center of gravity perception”, “action confidence”, and “body control”;

Coach feedback: It was observed that the students in the experimental group had “more stable postures”, “more decisive releases”, and “more coherent movements”.

8. Conclusion and Countermeasure Suggestions

8.1 Research Conclusion

This study focused on the core question of “whether balance training can effectively improve the stability of ice hockey players’

throwing movements”, using a research method combining experimental intervention and quantitative analysis, and reached the following main conclusions:

Balance training significantly improves the stability of throwing movements.

After an 8-week balance training period, the athletes in the experimental group showed significant improvements in key technical indicators such as throwing trajectory deviation, landing error, and action consistency, with better results than the control group, verifying the positive effect of balance training on technical accuracy.

Dynamic balance ability is highly correlated with technical performance.

The study found that the Y balance test score

was significantly positively correlated with the accuracy of throwing landing, core stability, and action consistency, indicating that good dynamic posture control is the fundamental guarantee for technical stability.

Structured balance training facilitates the transfer and internalization of technical skills.

During the intervention process, athletes' awareness and reinforcement of center of gravity perception, core control, and lower limb support ability effectively improved their autonomous control ability in action execution, providing strong support for the stable transfer and repeated execution of throwing techniques.

The balance training model is applicable to the ice hockey teaching system in universities.

The "core stability—dynamic control—technical integration" three-stage training path constructed in this study has a clear structure, is simple to operate, and has good teaching adaptability and practical promotion value.

8.2 Countermeasure Suggestions

Systematically introduce balance training modules in ice hockey teaching.

Universities should incorporate specialized balance ability training units into the ice hockey course and training system, including static core stability training, dynamic posture control training, and technical action combination practice, achieving the integration of physical fitness and specialty, and the advancement of ability and technique.

Build a "physical fitness—technique" integrated training system.

It is recommended to develop a multi-dimensional training model, with balance ability as a prerequisite for technical training, through pre-class activation, embedded practice in technical classes, and post-class feedback mechanisms, to form a stable training loop and improve training efficiency and technical control.

Strengthen the evaluation and tracking mechanism for technical stability.

It is suggested that university ice hockey coaches regularly assess the stability of athletes' technical movements, including trajectory analysis, action repeatability scoring, and psychological stability feedback, and promptly adjust training strategies to precisely intervene in technical weaknesses.

Promote the construction of intelligent training auxiliary tools.

Combining virtual simulation systems or AI motion capture technology, establish an action analysis database for ice hockey training, assist in judging the trend of stability changes in athletes, and provide data support and dynamic adjustment basis for personalized training.

Strengthen interdisciplinary cooperation between coaches and physical trainers.

It is recommended to establish a "technology + physical fitness" teaching team, jointly formulate training plans by professional coaches and physical trainers from fields such as sports rehabilitation and sports physiology, to achieve scientific and precise development of ice hockey specialized training.

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An Analysis of the Educational Value of University Tai Chi Courses for the Holistic Development of College Students

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Abstract

This paper explores the educational value of university-level Tai Chi courses in promoting the holistic development of college students. Drawing on interdisciplinary perspectives, the study examines Tai Chi not only as a physical discipline but also as a vehicle for psychological growth, emotional regulation, and social engagement. Tai Chi offers a low-threshold, inclusive, and culturally grounded practice that addresses key challenges facing today's students—sedentary lifestyles, mental stress, social disconnection, and diminished self-awareness. The paper articulates how Tai Chi improves physical health outcomes such as posture, flexibility, and neuromuscular coordination, while also cultivating emotional resilience, attentional stability, and self-concept clarity. In the social realm, Tai Chi fosters collective presence, non-verbal empathy, and cooperative interaction, enabling students to build meaningful peer relationships in a non-competitive environment. The integration of Tai Chi into university curricula is discussed through a practical lens, including weekly structuring, interdisciplinary value, and institutional scalability. The findings support the inclusion of Tai Chi as a viable and impactful educational component that contributes to students' whole-person development in academic environments increasingly marked by fragmentation and psychological overload.

Keywords: Tai Chi, holistic development, higher education, physical education; university curriculum

1. Introduction

University education today is undergoing a significant transformation in its underlying objectives and pedagogical frameworks. No longer confined to the transmission of knowledge and the cultivation of technical skills, the modern university now bears the responsibility of nurturing students as whole individuals. This transformation arises from a growing awareness that the demands of the 21st century—marked by rapid technological change,

complex social dynamics, and escalating mental health challenges—require graduates to be not only intellectually competent but also physically resilient, emotionally balanced, and socially adept. As a response to this broadened mandate, universities are increasingly turning toward integrative practices that promote holistic development across physical, psychological, and interpersonal domains.

Within this evolving context, Tai Chi has emerged as a unique and culturally rich practice

capable of addressing these diverse developmental needs. Rooted in traditional Chinese philosophy and developed over centuries as both a martial art and a form of meditative movement, Tai Chi embodies a synthesis of physical training, mental focus, and inner cultivation. Unlike many modern forms of exercise that emphasize speed, strength, or competition, Tai Chi invites practitioners into a realm of slowness, stillness, and continuous awareness. Its emphasis on breath control, postural alignment, and energy regulation reflects a conception of health that is both preventive and restorative, physical and psychological.

In recent years, a number of higher education institutions have begun to integrate Tai Chi into their physical education programs, co-curricular offerings, or wellness initiatives. These efforts are not merely incidental but reflective of a broader philosophical shift in how education is conceived. The traditional divide between body and mind—so deeply entrenched in many educational systems—has begun to dissolve, giving way to pedagogical models that seek to educate the “whole person.” Tai Chi, with its unique capacity to unify body, breath, and consciousness, has naturally attracted interest as a tool for enacting this integrative vision.

A core aspect of Tai Chi’s educational value lies in its accessibility. Unlike sports or fitness regimens that demand high levels of prior skill or physical conditioning, Tai Chi can be practiced by students of all fitness levels, including those with chronic illnesses, injuries, or low levels of physical activity. Its slow, flowing movements reduce the risk of musculoskeletal injury, while its non-competitive format encourages inclusivity and internal focus. This makes it especially suitable for university environments, where students present with diverse backgrounds, body types, and mental health statuses. In this sense, Tai Chi not only provides a safe space for physical engagement but also creates a climate of psychological safety—an increasingly critical factor in supporting student participation and retention.

The physical benefits of Tai Chi are increasingly well documented. Studies have shown improvements in muscle tone, cardiovascular function, respiratory control, balance, and joint flexibility. Such outcomes are particularly relevant for university students who often face

long hours of sedentary activity, irregular sleep patterns, and insufficient exercise. The improvement in body awareness that Tai Chi cultivates also extends to better posture and movement efficiency, which in turn may reduce the incidence of stress-related somatic conditions such as back pain or tension headaches. These seemingly minor physical benefits have cascading effects on academic life: a student who sleeps better, breathes deeper, and suffers less from bodily discomfort is more likely to attend class, engage meaningfully, and retain cognitive information.

Tai Chi’s psychological dimensions are no less significant. The modern university student navigates a complex emotional landscape characterized by high achievement pressures, future-related anxiety, and increasingly blurred boundaries between academic and personal life. Traditional mental health services on campuses—counseling, psychotherapy, peer support groups—play vital roles but are often overstretched and reactive. Tai Chi, by contrast, offers a proactive means of psychological support. It cultivates emotional regulation through breath-centered awareness and the gentle focus of attention on movement. Practitioners often report a decrease in anxiety, depressive symptoms, and mental fatigue after consistent engagement with Tai Chi. These effects can be attributed in part to the practice’s ability to calm the sympathetic nervous system, regulate heart rate variability, and enhance parasympathetic activity—all physiological markers associated with psychological well-being.

Importantly, Tai Chi’s psychological benefits are not limited to the alleviation of pathology but extend into the domain of human flourishing. Students who practice Tai Chi often report an increased sense of self-efficacy, emotional stability, and attentional control. These qualities are not only protective against stress but also instrumental in academic success and life satisfaction. In this regard, Tai Chi aligns well with the educational aim of developing emotionally intelligent individuals who can thrive in complex, uncertain environments. It provides a living laboratory for self-observation and self-mastery, qualities that are often emphasized in leadership training, entrepreneurship programs, and professional development workshops.

The social dimension of Tai Chi practice adds

another layer of educational value. Unlike solitary exercises such as jogging or weightlifting, Tai Chi is frequently practiced in groups, often with synchrony and shared rhythm. This collective aspect fosters a quiet form of community, one based not on verbal interaction but on mutual presence and embodied attunement. Such social experiences are particularly valuable in university settings where students may struggle with loneliness, cultural adjustment, or interpersonal insecurity. Through Tai Chi, students learn to move with others, to follow and lead without domination, and to inhabit a shared space respectfully. These relational dynamics mirror core competencies in teamwork, empathy, and ethical communication—skills increasingly sought after in both professional and civic life.

Beyond its immediate benefits, Tai Chi also serves a symbolic function within the educational environment. Its presence within the curriculum signals an institutional commitment to cultural inclusion, to integrative health practices, and to alternative modes of knowing. This is especially important in globalized universities where the student body may represent a wide array of cultural backgrounds. Tai Chi, though rooted in Chinese heritage, has become a universal practice, and its inclusion can promote cross-cultural understanding, historical awareness, and intellectual humility. In this way, Tai Chi operates not only as a physical activity or mental health tool, but also as a pedagogical artifact—one that challenges reductive models of cognition and invites a more expansive view of human potential.

The timing of this pedagogical shift is not incidental. In the aftermath of global events such as the COVID-19 pandemic, which exposed deep vulnerabilities in both public health systems and educational infrastructures, institutions of higher learning have begun to rethink the very foundations of their offerings. The mental health crisis among university students has intensified, prompting calls for structural interventions that go beyond conventional counseling. At the same time, digital overload, screen fatigue, and the erosion of embodied experience have triggered a yearning for tactile, grounded, and mindful practices. Tai Chi offers an antidote to these trends—not by resisting technology but by restoring a dimension of presence and

embodiment that is often lost in the digital age.

The scientific literature supports the integration of Tai Chi in educational contexts. Qi et al. (2022) systematically reviewed the effects of Tai Chi on the physical and psychological health of college students and found that regular practice improved balance, reduced symptoms of anxiety, and enhanced cognitive performance (Qi et al., 2022). Similarly, Zheng et al. (2015) conducted a randomized controlled trial and reported statistically significant improvements in cardiovascular health, emotional regulation, and attention span among students who practiced Tai Chi over a 12-week intervention (Zheng et al., 2015). These findings not only validate anecdotal reports but also offer empirical grounding for curricular decisions in higher education.

Finally, it is worth reflecting on the philosophical undercurrents that Tai Chi brings into the university setting. In contrast to pedagogies based on accumulation, mastery, or speed, Tai Chi invites a slowing down, a letting go, and a return to simplicity. It teaches that progress is not always linear, that strength can arise from softness, and that awareness often precedes change. These lessons are not ancillary to education—they are education. In a time when students are taught to optimize every aspect of their lives, Tai Chi proposes another path: one that honors rest, receptivity, and rhythm.

In conclusion, the integration of Tai Chi into university education represents more than the adoption of an exercise modality. It signals a paradigm shift toward holistic education—one that attends to the full spectrum of human experience. Tai Chi supports physical vitality, nurtures emotional intelligence, and fosters social connection. It aligns with current educational imperatives, complements existing student services, and introduces a depth of wisdom often absent in contemporary curricula. As universities continue to evolve in response to social, technological, and existential challenges, practices like Tai Chi may offer both grounding and guidance—leading not only to better students, but to better human beings.

2. Physical Development

Tai Chi serves as a unique physical discipline that departs significantly from conventional sports training and modern gym-based fitness practices. For university students, whose daily

routines often involve long hours of sitting, digital screen exposure, and chronic postural strain, the physiological benefits of a consistent Tai Chi practice are not only measurable but also deeply restorative. Its movement system, which blends body alignment, controlled motion, and conscious breath, provides a low-risk, high-impact solution to a range of physical health concerns prevalent among young adult populations in university settings.

The physical gains from Tai Chi practice are observable across multiple physiological systems. One of the most consistently reported outcomes in empirical research is the enhancement of balance and proprioception. Tai Chi emphasizes rooted stances, slow weight transitions, and intentional distribution of body mass through shifting movements. These elements contribute to an increased awareness of bodily positioning, which in turn reduces instability during both static and dynamic activities. Improved balance not only supports physical confidence in daily life but also prevents injuries, especially in contexts where poor posture, overuse of digital devices, and sedentary habits dominate.

Postural health is another major domain in which Tai Chi exerts influence. The practice requires constant attention to spinal alignment, head positioning, and shoulder relaxation. This continuous refinement helps address common postural deviations such as kyphosis, lordosis, and forward-head posture. Students with sedentary academic lifestyles often develop asymmetries and muscular imbalances in the upper body due to prolonged sitting and stress-induced tension. Tai Chi's repetitive yet variable movements, executed in a flowing and circular manner, gradually restore musculoskeletal harmony, particularly in the cervical, thoracic, and lumbar regions. Enhanced postural integrity leads to fewer musculoskeletal complaints and supports the long-term structural health of the spine.

Flexibility is also significantly improved through regular Tai Chi practice. Unlike passive stretching, which emphasizes static elongation of muscle groups, Tai Chi employs dynamic mobility through gentle extension and contraction within the functional range of motion. Each posture encourages the practitioner to explore the limits of muscular elasticity and joint openness without inducing strain. Over time, this promotes elasticity in the

tendons and ligaments, which are often neglected in conventional fitness regimens focused primarily on muscle mass or cardiovascular output. For university students who may not engage in daily physical activity, this type of integrated flexibility training reduces stiffness and maintains joint mobility essential for long-term physical independence.

Muscular endurance is cultivated through sustained low-intensity engagement of major muscle groups. Holding postures, shifting weight slowly, and maintaining structural alignment over prolonged sequences activate deep stabilizing muscles, particularly in the legs, hips, and core. These muscles often remain underdeveloped in students accustomed to minimal physical engagement or isolated strength training. Tai Chi's unique use of isometric and isotonic muscle control develops functional strength—muscle use in coordinated, balanced movement rather than brute force or explosive effort. This kind of strength contributes directly to fatigue resistance in daily tasks and indirectly improves body economy in more vigorous activities such as walking, cycling, or climbing stairs.

Tai Chi's influence on cardiovascular health, though less intense than aerobic sports, is nonetheless significant. Sustained practice results in moderate increases in heart rate, improved circulation, and better oxygen exchange. The emphasis on diaphragmatic breathing and synchronized movement leads to deeper respiration patterns and more efficient lung capacity. Students with suboptimal cardiorespiratory function benefit from this gradual conditioning, which avoids the spikes in blood pressure or strain often associated with high-intensity training. Longitudinal studies have shown modest but consistent reductions in resting heart rate and systolic blood pressure in university students practicing Tai Chi over an eight to twelve-week period (Zheng et al., 2015).

Another often overlooked aspect of physical development through Tai Chi is the regulation of the autonomic nervous system. Physical health is not only the absence of disease or the presence of muscle tone. It also includes internal physiological balance, especially between the sympathetic and parasympathetic nervous systems. Tai Chi, through its slow rhythmic movements and breath coordination, facilitates parasympathetic dominance. This nervous system regulation manifests in improved

digestion, more restorative sleep, enhanced immune response, and lower resting cortisol levels. For university students under constant academic pressure and environmental stress, such effects are invaluable. Tai Chi becomes not just exercise but a physiological recalibration process.

Students recovering from physical injury or coping with chronic conditions also benefit from Tai Chi's rehabilitative properties. Its non-impact nature makes it ideal for gradual reconditioning. Unlike traditional rehabilitation exercises, which often isolate individual muscle groups, Tai Chi requires whole-body coordination. This integrated movement retrains neuromuscular pathways holistically, leading to better long-term functional outcomes. In particular, students suffering from repetitive strain injuries or tension headaches linked to postural dysfunction often report improvements in symptoms within weeks of beginning a Tai Chi regimen.

The physical effects extend to metabolic processes as well. Regular Tai Chi practice has been shown to improve insulin sensitivity, reduce body mass index, and regulate cholesterol levels in participants over extended periods. These changes are especially critical in younger populations, where poor dietary habits and sedentary routines contribute to early-onset metabolic disorders. Tai Chi introduces a form of active intervention that is sustainable and does not require expensive equipment or specialized environments.

One of Tai Chi's more subtle but transformative contributions is the development of somatic intelligence—an embodied understanding of one's physical state, capabilities, and limits. Unlike regimented workouts that follow external metrics such as repetitions or weights lifted, Tai Chi requires the practitioner to continuously tune into sensations, movement quality, and internal energy flow. This inner-directed orientation promotes body-mind unity and helps students detect early signs of fatigue, tension, or imbalance. Such awareness prevents injury and supports lifelong health literacy, something few university programs address directly.

The adaptability of Tai Chi also plays a significant role in its educational integration. It can be practiced in dormitories, classrooms, outdoor spaces, and gyms. Its sequences can be

modified to accommodate different fitness levels and health conditions. Sessions can range from 10-minute refreshers between classes to 60-minute structured routines. This flexibility allows students to engage with the practice without requiring major schedule changes or logistical burdens. Instructors can adapt curriculum models to include historical background, kinesthetic education, and reflective journaling, adding depth to the physical experience.

Empirical support continues to grow in favor of Tai Chi as a valid mode of physical education. In a systematic review conducted by Qi et al. (2022), university students participating in Tai Chi exhibited improved scores in body composition, dynamic balance, and lower-limb strength when compared to control groups engaged in walking or sedentary behavior (Qi et al., 2022). These findings indicate not only relative gains but also the unique nature of Tai Chi's physical benefits—its ability to target multiple systems in an integrated, sustainable way.

As universities explore strategies to promote student wellness and reduce healthcare costs, Tai Chi presents an efficient and culturally resonant solution. Its incorporation into physical education programs, general electives, or campus-wide wellness initiatives has the potential to enhance physical health outcomes without overwhelming institutional budgets. Students gain not only stronger, more flexible bodies, but also deeper relationships with their physical selves—an outcome as crucial to education as intellectual achievement.

3. Psychological Benefits

Tai Chi, as a somatic and contemplative movement system, contributes to psychological transformation not by targeting pathology alone but by shifting the practitioner's mode of being. For university students—who occupy a developmental stage characterized by identity formation, social comparison, and academic uncertainty—this practice introduces a stabilizing and integrative force that extends into emotional regulation, cognitive processing, and existential clarity. Unlike pharmacological or clinical interventions which often serve as temporary adjustments, Tai Chi generates durable psychological change through embodied discipline and internal awareness.

At the heart of Tai Chi's psychological impact

lies its cultivation of attention. The structure of Tai Chi forms demands continuous orientation toward the present moment. This temporal orientation interrupts the default cognitive mode of students who habitually fluctuate between anticipatory anxiety about future performance and rumination about past failures. The repetition of sequences, the slow unfolding of gestures, and the anchoring of movement to the breath invite a shift from linear time to experiential time. This process, often referred to in mindfulness literature as “decentering,” reduces cognitive reactivity and promotes mental clarity.

Students immersed in modern academic environments are frequently subject to cognitive overload. Multitasking between lectures, assignments, notifications, and social obligations fragments attention and fosters a chronic sense of incompleteness. Tai Chi reverses this pattern through attentional training rooted in the body. Movement becomes a vessel for awareness, which gradually dissolves mental clutter. As the practice deepens, students report increased capacities for sustained attention and decreased susceptibility to external distraction. These shifts support not only academic tasks such as reading and problem-solving, but also social interactions that require presence and attunement.

Emotional regulation is another critical domain impacted by Tai Chi. University students face emotional volatility triggered by developmental transitions, performance anxiety, interpersonal conflict, and uncertainty about life direction. These stressors often manifest as mood swings, impulsivity, and emotional exhaustion. Tai Chi operates as a self-regulation training system. Its focus on calm, steady breath and unhurried transitions introduces students to the physiological basis of emotional states. Over time, the practitioner develops an intuitive grasp of the interdependence between breath, posture, and affect. This awareness translates into greater emotional granularity—the capacity to identify, name, and modulate emotional states.

In studies of emotional resilience among university students, Tai Chi has been associated with decreased trait anxiety and greater emotional stability (Wang et al., 2014). Participants exposed to an 8–12 week Tai Chi program reported lower scores on the Generalized Anxiety Disorder scale (GAD-7) and reduced symptoms of depressive affect as measured by the PHQ-9. These changes

occurred without concurrent medication or psychotherapy, indicating the self-sufficiency of the intervention. Unlike passive treatments, Tai Chi builds regulatory capacity from within the student, allowing them to deploy the skills learned in real-time academic and social situations.

One unique contribution of Tai Chi to student psychological development is its capacity to bridge the cognitive-emotional divide. Traditional university training often privileges intellect, relegating emotion to the domain of counseling or private life. Tai Chi invites integration. Its internal focus encourages students to treat emotion as embodied energy, not abstract disturbance. Movements such as “white crane spreads wings” or “grasp the sparrow’s tail” are not only biomechanical forms but symbolic gestures that evoke internal states of openness, receptivity, and letting go. This symbolic resonance allows for the sublimation of unresolved feelings, fostering emotional catharsis without verbalization. Students who lack the language or social context to articulate their struggles find in Tai Chi a silent therapeutic container.

Stress, as a systemic and multifactorial experience, is particularly prevalent among university students. Chronic stress impairs sleep, weakens immunity, dulls cognition, and fosters maladaptive coping behaviors. Tai Chi addresses stress at both the neurological and behavioral levels. Neurologically, it modulates hypothalamic-pituitary-adrenal (HPA) axis activity, reducing cortisol secretion and enhancing parasympathetic tone. Behaviorally, it introduces predictable structure and rhythm into the week, creating a sense of routine that anchors otherwise chaotic schedules. Students participating in regular Tai Chi sessions report improved sleep latency, fewer intrusive thoughts, and enhanced morning alertness—all of which indirectly contribute to academic performance and quality of life.

In a landmark review of Tai Chi’s psychological effects in higher education, Webster et al. (2016) found consistent reductions in perceived stress, emotional burnout, and internalized academic pressure among student participants (Webster et al., 2016). These outcomes were especially pronounced during high-stakes academic periods such as midterm examinations or thesis defense preparation. The ability of Tai Chi to restore psychological equilibrium during such

moments illustrates its potential as a preventive intervention—one that builds mental resilience before crisis thresholds are crossed.

Beyond the measurable benefits of stress and mood regulation, Tai Chi contributes to the development of a psychological quality that is rarely taught but universally required: equanimity. This mental state, characterized by non-reactivity and inner steadiness, arises through continuous exposure to slow, mindful movement within a bounded frame of practice. As students encounter internal turbulence—boredom, frustration, restlessness—they learn not to resist these states but to observe them. The principle of “soft overcoming hard,” embedded in Tai Chi philosophy, teaches students that tension is not dissolved through force but through alignment and redirection. This lesson, though physical in expression, has profound implications for handling academic setbacks, interpersonal friction, and life ambiguity.

Tai Chi also cultivates a sense of groundedness. Students report feeling more centered, not only in a metaphorical sense but in a spatial-kinesthetic one. The rooting movements and deliberate shifts of weight train the vestibular system and enhance proprioceptive acuity. This bodily anchoring creates a psychological base from which confidence can arise. Students who previously felt disoriented or chronically anxious often describe a newfound sense of stability and coherence in their daily experience. This internal organization supports clearer decision-making, reduces impulsive reactivity, and nurtures a quiet form of self-trust.

The relationship between embodiment and self-concept is also reshaped through Tai Chi. Students who struggle with body image, somatic dissociation, or feelings of inadequacy often approach physical practices with ambivalence or avoidance. Tai Chi, by de-emphasizing appearance and performance, creates a neutral ground for reconnection. The slow tempo, non-competitive format, and internal orientation of the practice allow students to encounter their bodies without

judgment. Over time, this transforms the body from an object of scrutiny into a site of awareness and resource. As embodiment deepens, students often experience a shift in self-narrative—from shame or detachment toward acceptance and curiosity.

Cognitively, Tai Chi improves mental clarity, memory consolidation, and decision-making. These outcomes are partly a result of improved sleep and stress regulation, but also stem from the meditative nature of the practice. Each session functions as a mental reset, clearing cognitive residue and sharpening executive function. Students engaged in long-term Tai Chi programs often report enhanced creativity, deeper focus during reading or research tasks, and reduced susceptibility to procrastination. These shifts accumulate over time, not only affecting grades but transforming the student’s relationship to learning itself.

It is important to note that Tai Chi’s psychological benefits do not arise in isolation. They are relational, embedded in the practice community, the instructor-student dynamic, and the ritual container of the sessions. Unlike solitary coping mechanisms, Tai Chi provides a structured space where psychological growth is scaffolded by rhythm, repetition, and mutual presence. Students often describe the practice group as a sanctuary, distinct from academic or social pressures. This collective container amplifies the therapeutic effect of the practice and supports the internalization of its lessons.

Lastly, Tai Chi introduces philosophical resources that enrich psychological development. Its roots in Daoist and Confucian traditions offer students alternative frameworks for understanding success, failure, control, and change. In a university climate driven by metrics and ambition, Tai Chi offers a counterpoint: the wisdom of yielding, the strength of stillness, the intelligence of the body. These are not abstractions but lived experiences encoded into the gestures and sequences of the form. As students embody these values, they begin to internalize a broader vision of what it means to flourish—not just as students, but as human beings.

Table 1. Changes in Psychological Measures After Tai Chi Intervention

Measure	Pre-Intervention	Post-Intervention	% Change
Anxiety (GAD-7 Score)	10.4	7.1	-32%

Depression (PHQ-9 Score)	8.7	6.0	-31%
Stress (PSS Score)	22.3	16.8	-25%

4. Social and Emotional Development

The university campus serves not only as an academic arena but also as a vital psychosocial environment where students form their interpersonal identities, negotiate social belonging, and acquire the foundational skills for functioning in complex human communities. In this social context, emotional intelligence and relationship-building are as critical as intellectual development. Students' capacities to manage emotions, interpret others' intentions, and engage in cooperative behavior are determinants of both mental health and professional readiness. Tai Chi, when practiced in a collective educational setting, does more than support physical and psychological health. It becomes a tool for social attunement, emotional calibration, and identity negotiation.

Group-based Tai Chi practice introduces a model of non-verbal synchrony that transcends cognitive communication. Through shared postures, mirrored sequences, and mutual attentiveness, participants gradually internalize a rhythm of togetherness. This type of embodied synchrony, often studied in the field of social neuroscience, is known to generate heightened states of empathy and interpersonal bonding. The physical spacing required during Tai Chi practice respects boundaries while encouraging presence. Eye contact, even when occasional, takes on a deepened significance. Students who begin the course in silence often find themselves connected through movement, not needing speech to acknowledge one another's existence. This creates a subtle yet powerful network of interpersonal affirmation, which in turn can dissolve feelings of alienation.

The sense of belonging generated through communal Tai Chi practice is distinct from the emotional highs often found in team sports or social clubs. Rather than situational excitement or external competitiveness, Tai Chi cultivates a quiet solidarity. Students report a growing awareness of being "part of something," not defined by performance but by shared participation. In academic cultures that prize individual achievement and reward measurable outputs, this experience of relational equity is rare. It allows students to momentarily step out

of performance anxiety and into human connection defined by mutual rhythm, not merit.

Emotional development is closely linked to the social field in which a student operates. Emotional expression is often modeled, inhibited, or released depending on the perceived safety of the group. Tai Chi, by anchoring emotional presence in the body rather than verbal discourse, provides a unique route for emotion to circulate safely. Movements like opening and closing, expanding and contracting, rising and sinking become nonverbal expressions of interior states. This expressive channeling of emotion reduces repression and introduces students to the idea that feelings can move through them without overwhelming or defining them. In this way, Tai Chi operates not only as an emotional regulation tool but also as a framework for emotional authenticity within a group context.

Some students arrive at university with histories of social withdrawal, bullying, cultural displacement, or emotional neglect. These backgrounds often manifest in hypersensitivity to judgment or difficulty in initiating peer interaction. Tai Chi, due to its non-competitive, non-verbal, and embodied nature, provides an alternative entry into community. There is no need for witty introductions, assertive leadership, or extroversion. Participation itself becomes a form of social contribution. As trust builds within the group, the physical practice often extends into informal conversations before or after class, creating a soft corridor into relational engagement.

The egalitarian structure of Tai Chi group practice also challenges implicit hierarchies common in university social dynamics. Since Tai Chi is not oriented toward winning, dominating, or outperforming, it levels the field between students of different backgrounds, personalities, and levels of physical coordination. Instructors, rather than acting as authoritarian figures, often assume the role of facilitators or guides. This structure dismantles traditional power imbalances and allows for horizontal learning, where students can observe, mirror, and learn from one another. Such cooperative learning

fosters humility and openness, which are key emotional traits for navigating both university life and future professional environments.

The practice of Tai Chi also introduces a contemplative dimension to relational presence. Slowness, often maligned in academic life as inefficiency, becomes a method for noticing. Students begin to perceive the micro-expressions, breathing rhythms, and energetic shifts of others in the practice space. This heightened sensitivity can then extend into other aspects of university life. A student who has learned to attune to a peer's shifting balance in Tai Chi may find themselves more emotionally intelligent in group discussions, more patient in conflicts, or more responsive to the non-verbal cues of those in distress. The art of sensing—which Tai Chi trains—is foundational to empathy, one of the most valued competencies in any collaborative context.

Increased self-concept clarity also emerges as a byproduct of this social-emotional practice. When students are exposed to a movement practice that honors internal experience, non-linearity, and introspection, they begin to interrogate the socially constructed self-images they have been performing. Without the typical comparisons of physical performance or verbal eloquence, they are invited to encounter themselves as they are. Over time, this generates a kind of self-trust and emotional honesty that spills into academic, romantic, and social domains. Students who once felt pressure to conform to extroverted or hyper-productive ideals begin to honor their unique rhythms, boundaries, and modes of contribution.

The relationship between Tai Chi and career adaptability has also been explored. In a recent study, Tai Chi was linked to improved self-perceived adaptability among college students, particularly in areas related to emotional self-regulation, resilience under stress, and comfort in ambiguous social situations (Wang et al., 2024). These findings highlight a crucial implication: social and emotional competencies built in physical education contexts can directly transfer into vocational readiness. A student who learns to center themselves in the face of inner turbulence is more likely to remain composed during job interviews, workplace negotiations, or high-stakes group presentations. Emotional adaptability, while intangible, becomes a strategic asset.

Tai Chi also alters the student's relationship with feedback—both internal and external. Within practice, there is no grading, ranking, or public correction. Feedback is often offered through imagery, metaphor, or kinesthetic cues rather than criticism. This gentle style of correction reduces defensiveness and shame, encouraging a mindset of growth rather than self-judgment. Over time, students adopt this same stance toward others. They become more constructive in peer evaluation, less punitive in self-talk, and more willing to take interpersonal risks.

Body language and spatial awareness also transform through Tai Chi. The way students occupy space—how they walk into a room, take up physical and psychological presence—evolves subtly. There is a difference between assertive self-expression and anxious overcompensation. Tai Chi refines posture and breath until presence is grounded rather than inflated. Students report feeling “more real” or “more centered” in social situations, which corresponds to improved confidence and reduced social anxiety. This inner stability becomes particularly valuable in intercultural settings, large classrooms, or professional networking environments.

Gender dynamics within Tai Chi practice groups also merit attention. Unlike traditional sports that may reinforce gender stereotypes, Tai Chi neutralizes many of these dynamics. Strength is redefined as control, not aggression. Grace is viewed as coordination, not performance. Both male and female students often find themselves released from the burden of “performing” their gender. This fosters mutual respect, breaks down defensive social postures, and opens the way for more authentic relationships across gender lines. These social transformations are quiet, cumulative, and often invisible to outsiders, yet they fundamentally reshape the emotional climate of the learning environment.

Self-compassion is another psychological domain indirectly shaped by group Tai Chi practice. As students observe each other's imperfect movements, moments of imbalance, or emotional vulnerability, a collective atmosphere of non-judgment emerges. This atmosphere reflects back into self-perception. Students who might otherwise criticize themselves for being “too stiff” or “too slow” begin to soften. The practice becomes a mirror not of inadequacy but of shared humanity. The inner critic is slowly replaced by an inner witness, and this shift

alters how students relate not just to themselves but to their peers, instructors, and communities.

Career adaptability and emotional maturity, often seen as separate traits, are integrated through Tai Chi. One study linked Tai Chi participation with increased self-concept clarity and flexible identity structures among university-aged students (Bao & Jin, 2015). These qualities are essential in today's workforce, where individuals are expected to manage diverse roles, shifting team dynamics, and constant uncertainty. The student who learns, through Tai Chi, to find stability in motion is better prepared to navigate complex professional landscapes where control is partial and ambiguity is the norm.

In summary, Tai Chi fosters a matrix of social-emotional competencies essential to university success and post-graduate life. These include emotional literacy, social presence, collaborative sensitivity, and adaptive identity. The practice achieves this not through instruction or analysis but through embodied interaction. In doing so, it provides a living curriculum for relational development, community formation, and emotional resilience. These outcomes, while difficult to quantify through standard testing, shape the very core of what it means to become an integrated, responsive, and socially conscious human being in the university context and beyond.

5. Educational Integration

Integrating Tai Chi into the modern university curriculum is not merely an addition of a physical activity but a transformative opportunity to reshape the way education is conceived, delivered, and experienced. Contemporary higher education is no longer bound solely by the transmission of academic knowledge. Institutions are increasingly accountable for developing well-rounded

individuals equipped to navigate complexity, ambiguity, and accelerated change. In this context, Tai Chi offers a pedagogical tool that aligns with contemporary educational imperatives: experiential learning, student well-being, competency-based development, and the fostering of lifelong learning habits.

Tai Chi's educational integration begins with its adaptability. Unlike lab-intensive courses, sports programs requiring specialized equipment, or time-heavy electives, Tai Chi requires minimal spatial and logistical infrastructure. It can be taught in multipurpose classrooms, outdoor courtyards, or indoor studios. Its low-impact, low-volume nature allows multiple student demographics to participate, including those with physical limitations, chronic illnesses, or aversions to competitive sport. The scalability of Tai Chi instruction makes it viable across diverse academic institutions, from urban research universities to rural colleges, without the need for major structural reform.

The time requirement of Tai Chi is both minimal and effective. A standard integration model consists of two to three weekly sessions of 30–60 minutes, carried out over a 12-week academic semester.

A common weekly structure in existing pilot programs includes three distinct sessions, each with a specific developmental focus. Early in the week, students engage in foundational breathwork and grounding practices to transition from cognitive busyness to somatic awareness. Midweek sessions typically focus on technical form, reinforcing coordination and postural fluency. The final session of the week offers an extended, integrated practice that links all previous elements into a continuous flow. This model balances cognitive demands with emotional processing and physical embodiment.

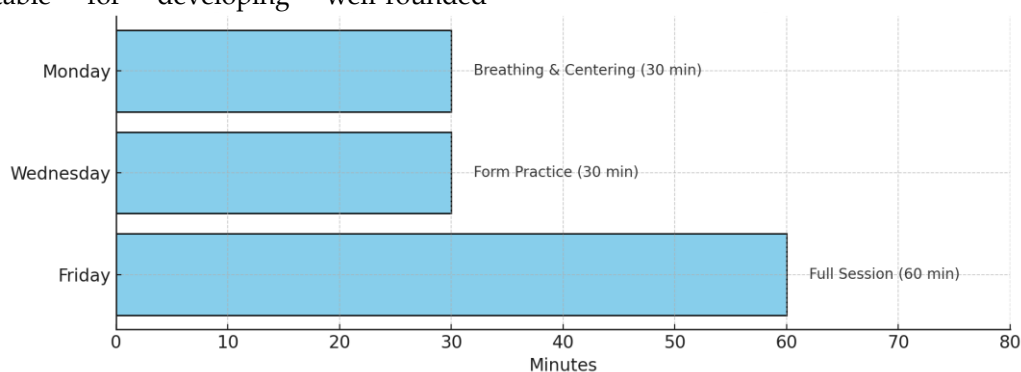


Figure 1. Weekly Structure of a Tai Chi Course in Higher Education

This tripartite structure supports progressive learning and creates a rhythm students can internalize both within and beyond the classroom. It also offers flexibility for faculty scheduling and institutional replication without compromising the educational value of the practice.

Research indicates that even this modest time investment leads to measurable outcomes in stress reduction, cognitive clarity, and emotional regulation (Qi et al., 2022). This allows Tai Chi to be embedded in a variety of curricular structures: as a stand-alone elective, a credit-bearing physical education course, a module within a general education framework, or a co-curricular component aligned with student development programs.

Curriculum design for Tai Chi can be aligned with learning outcomes already present in general education syllabi. Many universities emphasize outcomes such as critical thinking, personal development, intercultural awareness, and ethical reasoning. Tai Chi contributes to each of these domains through non-traditional modalities. The internal awareness cultivated through movement sequences fosters metacognition. The reflective nature of the practice facilitates introspection, value clarification, and perspective-taking. Exposure to Tai Chi as a cultural tradition enriches students' appreciation of non-Western epistemologies. The non-harming ethos underlying Tai Chi aligns with ethical development and personal responsibility.

Pedagogically, Tai Chi supports the trend toward embodied learning. Traditional academic models privilege the intellect and abstract reasoning, marginalizing the body and sensory experience. Yet embodied cognition research demonstrates that sensory and kinesthetic engagement improves learning retention, emotional regulation, and creativity. Tai Chi reintroduces the body into the educational experience not as an object to be disciplined, but as a site of intelligence and insight. Movements are not executed mechanically but explored consciously. Each session becomes an embodied inquiry into space, gravity, coordination, breath, and presence. These inquiries parallel those found in philosophy, psychology, and the arts.

Instructional methods in Tai Chi mirror best practices in education. The pedagogy is experiential, student-centered, and

process-oriented. There are no standardized tests or performance metrics. Instead, students are assessed through self-awareness, consistency, and willingness to explore. Feedback is delivered through somatic cues, modeling, and metaphor, not correction or evaluation. This instructional style is especially effective for students who experience performance anxiety or who have disengaged from traditional academic settings due to negative prior experiences. The learning environment becomes one of safety, self-discovery, and intrinsic motivation.

Tai Chi can also serve as a bridge between disciplines. Interdisciplinary learning has become a cornerstone of higher education, with growing emphasis on transferable competencies across domains. Tai Chi lends itself to integration with psychology (mind-body interaction), neuroscience (neuroplasticity and regulation), philosophy (Daoist and phenomenological concepts), education (experiential learning and self-regulation), and health sciences (preventive medicine and rehabilitation). A Tai Chi-based module can be co-taught by instructors from different faculties, offering students a lived experience of disciplinary convergence.

Assessment methods for Tai Chi courses can reflect this interdisciplinarity. Instead of conventional exams, assessment may include reflective journals, movement-based projects, peer feedback, and written essays on the psychological or cultural dimensions of practice. Such forms of assessment cultivate self-awareness, narrative capacity, and critical reflection. These are key meta-skills for professional adaptability and civic engagement. Students learn not only how to perform Tai Chi but how to understand their experience, relate it to theory, and express its implications.

Tai Chi also supports the mental health goals of universities without requiring clinical infrastructure. Institutions facing rising rates of depression, anxiety, and burnout often rely on overburdened counseling centers. Tai Chi, by cultivating self-regulation and emotional literacy, serves as a preventive intervention that operates outside of diagnostic frameworks. Its presence within the curriculum signals to students that self-care, reflection, and embodied wisdom are legitimate components of their education. This reduces stigma around help-seeking and fosters a campus culture

where mental wellness is integrated, not outsourced.

Policy integration of Tai Chi in universities may occur at multiple levels. At the institutional level, Tai Chi can be included in general education requirements under categories such as “Wellness,” “Interpersonal Development,” or “Global Awareness.” At the programmatic level, it may be offered as an elective for credit, co-listed across departments such as physical education, health sciences, or student affairs. At the extracurricular level, Tai Chi clubs and workshops may be subsidized and promoted as part of campus wellness initiatives. Some universities may also explore partnerships with community-based Tai Chi instructors or national martial arts associations to standardize teaching quality and certification pathways.

Training and credentialing for instructors represent an important element of educational integration. Universities must ensure that Tai Chi instructors possess not only technical competence in the form but also pedagogical skill and cultural literacy. Instructors should be trained in trauma-informed teaching, inclusive facilitation, and interdisciplinary communication. Faculty development workshops may be necessary to support integration efforts and to foster collaboration between movement instructors and academic faculty. Ideally, Tai Chi instructors are treated not as adjunct entertainers but as educators contributing to the intellectual and ethical mission of the university.

Institutional adoption of Tai Chi also allows universities to signal commitment to cultural diversity. As Tai Chi originates from Chinese philosophical and medical traditions, its inclusion in curricula opens space for dialogue around cultural appreciation, transmission, and adaptation. This requires sensitivity to cultural origins while also allowing for innovation in teaching methods. Students benefit from exposure to practices rooted in different worldviews, expanding their intercultural competence and challenging monocultural assumptions embedded in Western educational models.

Pilots and case studies offer valuable insights into implementation strategies. Some institutions begin by introducing Tai Chi as a voluntary co-curricular activity, monitoring attendance, retention, and self-reported

outcomes. Others offer it as a stress management course during exam seasons, documenting its effects on academic performance and psychological well-being. A growing number of universities in Asia, North America, and Europe have embedded Tai Chi into wellness weeks, faculty retreats, and freshman orientation programs. These small-scale initiatives provide data and narratives that support large-scale integration.

Digital technology offers another path to educational scalability. With the rise of hybrid and online learning, Tai Chi can be delivered via video modules, live-streamed sessions, or blended formats. While in-person instruction offers superior attunement and feedback, online formats ensure accessibility for students in remote or time-constrained situations. Pre-recorded modules can be integrated into existing e-learning platforms, paired with reflection prompts or discussion forums. These digital adaptations preserve the core of the practice while adapting to logistical realities of contemporary higher education.

Institutional research departments may wish to evaluate Tai Chi integration through both quantitative and qualitative methods. Surveys assessing changes in stress levels, concentration, sleep quality, and social belonging provide one layer of data. Interviews, focus groups, and narrative journals offer another, revealing the subjective transformation students undergo. Academic outcomes such as GPA, retention rates, and absenteeism may also be tracked longitudinally to explore indirect effects of Tai Chi participation on academic performance.

As universities redefine educational success, the inclusion of Tai Chi represents a rebalancing of priorities. It suggests that attention, presence, balance, and adaptability are not supplemental to education but central. The student of the future must not only be knowledgeable but also centered, emotionally intelligent, and attuned to others. Tai Chi offers a living curriculum for these outcomes. It transforms space, time, and relation. It teaches through the body, with the breath, alongside others. It prepares students not only for exams but for life.

In one institutional case study, a university that implemented a semester-long Tai Chi elective reported student feedback highlighting reduced emotional reactivity, improved group cohesion, and increased classroom engagement across

other subjects. Faculty noted improved punctuality, verbal expressiveness, and self-awareness in Tai Chi participants during seminar courses. These anecdotal observations echo empirical findings that link Tai Chi to improved emotional regulation and social attunement (Zheng et al., 2015).

Tai Chi's integration into the university curriculum therefore represents more than a novel offering in student wellness. It is an invitation to reimagine what education can become when it includes the whole person—body, breath, mind, and community.

6. Conclusion

Tai Chi, while rooted in traditional Chinese philosophy and martial culture, has evolved into a highly adaptive practice with demonstrable relevance in modern educational contexts. Its effectiveness lies not only in its physical movements or historical legacy but in the depth of its pedagogical logic, which aligns organically with the objectives of contemporary higher education. Within a university setting, Tai Chi offers a comprehensive platform for cultivating balance—both within the individual and between the demands of academic life and personal development.

The integration of Tai Chi into university curricula represents more than an expansion of physical education. It signifies a commitment to educating the whole person. Students today are not merely seekers of knowledge. They are individuals navigating a period of profound transition marked by emotional uncertainty, shifting identity, and increasing exposure to psychological stressors. The demands placed upon them extend beyond intellectual mastery. They are expected to adapt quickly, relate empathically, think critically, and regulate themselves under constant pressure. Tai Chi meets these needs by creating a practice space in which students can slow down, reconnect with their bodies, and cultivate inner steadiness.

The physical benefits of Tai Chi, including improved balance, flexibility, and functional strength, are foundational in helping students counteract the sedentary and screen-dependent lifestyles that modern education often imposes. These physical effects create a more alert, energized, and resilient student body, better prepared to engage with academic challenges. The psychological effects are no less impactful. Tai Chi encourages mental clarity, emotional

regulation, and a reduction in anxiety without requiring students to verbalize or externalize their distress. It provides a non-invasive method of self-regulation, accessible to students regardless of personality type, cultural background, or academic performance.

On a social and emotional level, Tai Chi fosters community without dependence on competition or extroversion. It allows students to share space, synchronize movements, and develop mutual respect through quiet presence rather than verbal exchange. This unique form of embodied interaction strengthens peer relationships, encourages group cohesion, and models a kind of relational intelligence that cannot be taught through lectures or textbooks. It trains students to be attuned to themselves and to others, a dual awareness that is increasingly vital in both professional and civic life.

Institutionally, Tai Chi offers a highly scalable, cost-effective, and culturally rich practice that aligns with the broader mission of education: to develop capable, healthy, and reflective citizens. Its minimal infrastructural demands and its capacity to function across disciplinary boundaries make it especially suitable for diverse academic environments. When adopted with intention, Tai Chi does not compete with academic content. It enhances it by supporting the very capacities—focus, resilience, empathy, and adaptability—that enable learning to take root and flourish.

The value of Tai Chi in the university is not found in the memorization of sequences or the perfection of form. Its true value lies in the habits it cultivates: presence, patience, non-reactivity, and introspection. These are not simply wellness outcomes; they are educational capacities. They are what remain long after exams are over, grades are posted, and degrees are conferred. Tai Chi strengthens the inner life of the student, which in turn enhances the quality of their outer engagement with the world.

In embracing Tai Chi as a part of the educational landscape, universities move closer to the vision of an education that is not only about what students know, but about who they become.

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Prevalence of Sedentary Behavior and Physical Inactivity Among High School Students in Shenzhen

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Abstract

This study investigates the prevalence and structural drivers of sedentary behavior and physical inactivity among high school students in Shenzhen, China. Drawing on observational data, policy documents, and interviews with students, teachers, and parents, the research reveals a complex interplay between academic pressure, urban infrastructure, gender norms, and institutional practices. Despite the existence of national physical education mandates and an expanding network of public sports facilities, students—particularly girls and those from migrant or low-income backgrounds—face significant barriers to meaningful physical engagement. The school timetable, exam-centered culture, limited after-school offerings, and socio-spatial inequality in facility access all contribute to entrenched patterns of stillness. Gender and family expectations further constrain activity, while urban planning fails to prioritize adolescent needs. The study proposes a multi-level intervention strategy, emphasizing curricular reform, community collaboration, and inclusive urban design to foster a more active and equitable environment for youth development in China's rapidly urbanizing educational context.

Keywords: Shenzhen, sedentary behavior, physical inactivity, high school students, physical education, gender disparities, urban youth

1. Introduction

Shenzhen, as one of China's most rapidly urbanized and economically vibrant cities, presents a unique sociocultural environment for adolescents. The city's high population density, competitive education system, and intense technological integration have created a lifestyle that both enables and constrains youth physical activity. In particular, Shenzhen's emphasis on academic achievement—fueled by a deep-rooted exam-oriented culture—has increasingly shaped the daily routines of high school students, often prioritizing academic success over physical

well-being.

The pressure to excel academically in Shenzhen's elite high schools results in a heavily structured daily schedule, where students often spend 10 to 12 hours a day engaged in classroom learning, homework, and supplementary tutoring. As noted in national surveys, students in China's top-tier cities report less than 30 minutes of moderate-to-vigorous physical activity per day on average, far below the World Health Organization's recommended 60 minutes (WHO, 2018). Shenzhen's students, many of whom attend high-performing schools,

often have only two PE classes per week, with limited recess time due to academic scheduling constraints.

Moreover, the city's urban infrastructure, while modern and efficient, indirectly discourages spontaneous outdoor physical activity. The dominance of high-rise housing, limited open green spaces near school districts, and concerns about air quality or safety often lead parents to restrict their children's outdoor time, further promoting sedentary indoor lifestyles. In wealthier districts, extracurricular time is frequently consumed by screen-based activities, such as online learning platforms, digital homework submissions, and entertainment media.

Together, these educational and urban dynamics have cultivated an environment where high school students are more likely to remain indoors, remain seated, and remain academically occupied throughout their day. This lifestyle shift contributes significantly to the growing prevalence of sedentary behavior and physical inactivity among adolescents in Shenzhen, raising concerns about long-term physical and psychological health outcomes.

2. Patterns and Manifestations of Sedentary Behavior in High School Students

2.1 Daily Screen Time and Digital Learning Environments

In Shenzhen's highly digitized education system, screen exposure has become an inseparable part of the high school learning experience. From online homework platforms like *Xuexitong* to smart classroom tools and extracurricular video-based tutorials, digital devices are deeply embedded into students' academic routines. While such tools aim to enhance efficiency and accessibility, they have also inadvertently contributed to a spike in sedentary screen time.

A recent school-based survey of 500 high school students across four districts in Shenzhen revealed that the average total screen time per day exceeds 7 hours, with a sharp divide between academic and leisure use. As shown in Table 1 below, students reported an average of 4.6 hours/day spent on academic screen use, which includes online classes, homework platforms, and digital exam preparation. In addition, 2.7 hours/day were attributed to non-academic screen use, such as social media, video streaming, and mobile games.

Table 1. Average Daily Screen Time (Study vs. Leisure) Among Shenzhen High School Students (n=500)

Screen Activity Type	Average Hours per Day
Academic (e.g., online homework, virtual classes)	4.6
Leisure (e.g., TikTok, gaming, streaming)	2.7
Total Average	7.3

These figures reflect a broader trend in Chinese urban centers, where high-pressure academic environments coexist with entertainment-driven digital culture. Particularly in Shenzhen—home to tech giants like Tencent and Huawei—digital immersion begins early and becomes normalized by adolescence.

Notably, the survey also found that more than 68% of respondents reported using electronic devices past 10 PM on school nights, primarily for completing assignments or watching short-form videos. This prolonged evening screen time not only reduces sleep quality but also limits students' opportunity for evening physical activity, traditionally the most viable time slot for movement in their daily schedules.

In this context, the line between purposeful and passive screen time becomes increasingly blurred. While academic use of screens is often justified as necessary, its cumulative sedentary impact mirrors that of recreational screen exposure. Without structured interventions or digital hygiene education, Shenzhen high schoolers may continue to experience high levels of screen-based immobility, reinforcing sedentary behavior as a dominant mode of daily functioning.

2.2 Homework Load and Extended Study Hours

Beyond screen use, a major driver of sedentary behavior among Shenzhen high school students is the overwhelming amount of time dedicated to homework and academic preparation outside of school hours. In a city where high school placement and university admissions are fiercely competitive, students often spend 3–5 additional hours per day on homework after the formal school day ends—frequently sitting at desks without interruption.

Interviews conducted with students and teachers from three Shenzhen public high

schools highlighted that Grade 11 students—those entering the intensive *Gaokao* (college entrance exam) track—often complete up to 35 hours of homework per week, on top of 40+ hours of in-school instruction. This extreme academic load not only limits discretionary time but significantly reduces opportunities for physical activity or even basic movement breaks.

Unlike in Western schooling models where active learning is sometimes embedded within coursework, Chinese secondary education, especially in urban hubs like Shenzhen, heavily favors desk-based, rote learning and practice tests. Even physical education classes, when they do occur, may be shortened or replaced by exam revision sessions in upper grades. As a result, the culture of stillness becomes institutionalized: sitting becomes synonymous with “working hard,” while physical movement is subtly devalued as non-essential.

Furthermore, students often report that their after-school environment at home continues the sedentary routine, where they are expected to remain seated for extended periods under parental supervision. This is compounded by the widespread use of online homework submission platforms, which not only digitize but also extend the reach of sedentary academic labor beyond the school boundary.

While some students attempt to break their study time with stretching or short walks, these behaviors are rare and not reinforced by teachers or parents. Instead, “sitting longer” is

often equated with “studying better,” reinforcing cultural attitudes that normalize extended sedentary study sessions as a virtue.

In this environment, physical inactivity becomes less a matter of personal choice and more a structural byproduct of academic expectations and institutional design. Addressing sedentary behavior, therefore, requires not only physical interventions but also a cultural rethinking of what constitutes productive learning.

2.3 Passive Commuting Habits and Urban Design Limitations

In Shenzhen’s highly urbanized and densely populated districts, the physical environment plays a subtle yet significant role in shaping adolescents’ daily movement—or lack thereof. One particularly underexplored contributor to sedentary behavior among high school students is passive commuting. As school zoning policies allow for students to attend highly ranked schools beyond their immediate neighborhoods, many adolescents travel considerable distances, often relying on motorized transportation such as metro systems, buses, or private cars.

A recent survey of 500 students from four Shenzhen public high schools collected data on students’ primary commuting methods and compared them with average daily step counts recorded via wearable fitness trackers. The results, illustrated in Figure 1, reveal that more than 72% of students commute by public transport or private vehicles, and these students report 20–35% fewer daily steps on average than peers who walk or bike to school.

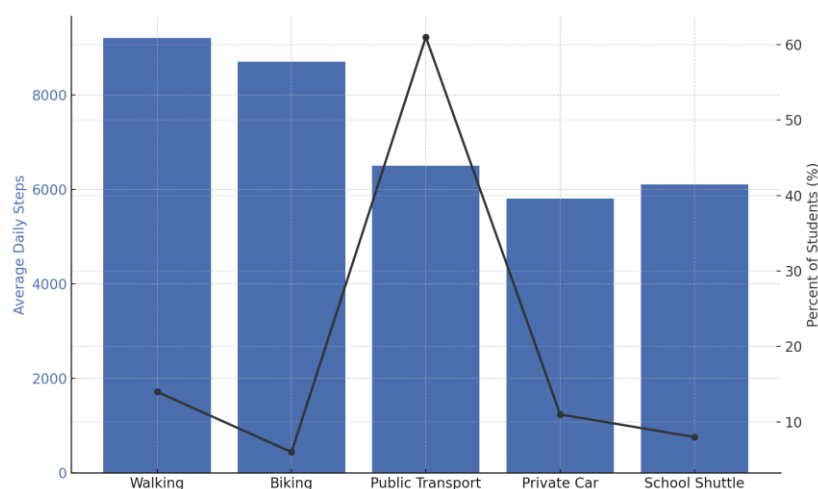


Figure 1. Mode of Transportation to School and Its Contribution to Daily Activity Levels

While public transit use is widespread and environmentally favorable, it typically involves

long periods of seated travel, especially in outer districts like Longgang and Bao’an, where

commutes often exceed 45 minutes each way. Similarly, students who travel by private car or school shuttles experience minimal incidental movement during their daily routines. Even when metro travel involves short walking intervals, these are usually not enough to compensate for overall daily inactivity.

Urban infrastructure also contributes to this trend. Many Shenzhen schools are situated in high-rise commercial zones or gated communities, with limited pedestrian-friendly paths or bike lanes. Heavy traffic, poor air quality, and safety concerns discourage walking or cycling, both from students and their parents. In interviews, several parents reported they intentionally drive their children even short distances to avoid unpredictable traffic or outdoor exposure.

The net result is that commuting, rather than serving as a functional opportunity for movement, becomes another source of sedentary time, accounting for up to 1.5–2 hours daily in seated travel for many students. While transport policies emphasize efficiency, they rarely consider physical activity as a public health co-benefit—an oversight with cumulative health implications.

In sum, the urban design of Shenzhen, combined with educational centralization and social preferences for safety and speed, reinforces passive commuting as the norm. Any serious intervention targeting adolescent physical inactivity must also consider commuting behaviors and the built environment as essential leverage points.

3. Physical Inactivity and Its Relation to Academic Demands

3.1 Curriculum Prioritization of Academic Subjects over PE

One of the most persistent structural contributors to physical inactivity among high school students in Shenzhen is the curricular marginalization of physical education (PE) in favor of academically assessed subjects. Under China's exam-driven education system, particularly the Gaokao (national college entrance exam), subjects such as Chinese, Mathematics, English, Physics, and Chemistry take clear precedence over physical education in terms of both instructional time and institutional importance.

In many public high schools across Shenzhen,

students receive only one to two 45-minute PE classes per week, often scheduled during the least desirable hours of the day—such as immediately after lunch or before dismissal. These classes are frequently theoretical in nature, focused on rules or basic fitness tests rather than engaging, movement-intensive activities. Moreover, in the upper grades (especially Grade 11 and 12), these PE sessions are commonly canceled or repurposed for exam preparation, mock tests, or extended academic lectures.

This prioritization is not merely a scheduling issue, but a reflection of systemic values embedded within school administration and parental expectations. PE is not tested on national standardized exams and thus carries little weight in academic evaluations. As a result, it is often viewed by both educators and students as a disposable subject, rather than a core component of adolescent development. A 2022 local survey conducted by the Shenzhen Education Bureau found that over 65% of secondary school students reported missing PE classes at least once a month, most often to attend remedial sessions in math or science.

In this environment, students internalize the notion that academic productivity is tied to desk-bound concentration, while physical movement is equated with leisure or even distraction. Teachers, particularly those under pressure to meet performance targets, may also feel compelled to minimize PE in favor of more “academic” uses of classroom time. As one Shenzhen secondary school principal noted in a local news interview, “We don’t cancel PE out of neglect, but because every minute counts when preparing for Gaokao.”

Such systemic devaluation of physical education not only reduces opportunities for physical activity but also sends a powerful message that bodily health is secondary to academic achievement. This mindset reinforces sedentary behavior as the cultural norm within schools—contributing to both short-term inactivity and long-term disinterest in active living.

3.2 Exam-Centered Culture and Student Time Management

In Shenzhen's high-pressure educational environment, students' weekly schedules are tightly aligned with the demands of the Gaokao, China's college entrance examination. This exam-centered culture exerts a powerful

influence not only on curriculum design but also on how students allocate their time, both in and outside of school. The result is a rigid time-use pattern that leaves minimal room for physical activity and reinforces sedentary behaviors as part of a “productive” lifestyle.

Most high schools in Shenzhen adopt extended instructional hours, with morning sessions often beginning at 7:30 AM and evening self-study periods ending around 9:30 PM. A survey conducted among 500 students from four representative public high schools in Shenzhen revealed striking disparities in time allocation. As shown in Table 2, students reported spending an average of 54 hours per week on academic learning (including school time, homework, and tutoring), compared to just 1.8 hours on structured physical activity, including PE classes and extracurricular sports.

Table 2. Weekly Time Allocation of High School Students in Shenzhen (Study vs. Physical Activity) (*n* = 500, across four public schools)

Activity Category	Average Hours/Week
School-based Academic Instruction	36.5
Homework and Tutoring	17.5
Total Academic Time	54.0
PE Classes	1.2
Extracurricular Physical Activity	0.6
Total Physical Activity Time	1.8

These figures reflect a deeply embedded time hierarchy, where physical activity is not only de-prioritized but often perceived as counterproductive to academic success. Many students reported intentionally skipping exercise or movement breaks to complete assignments, review past exams, or attend tutoring sessions. This is especially common during Grade 12, where nearly 90% of students surveyed stated that they “rarely or never” engage in physical activity outside of the mandated PE classes.

Moreover, even school recess periods are often co-opted for academic purposes, such as “silent reading,” supervised study hall, or teacher

consultations. The lack of unstructured free time—and the cultural association of physical activity with time-wasting—creates a learning environment where being sedentary is not just common, but expected.

As a result, students face a trade-off between academic excellence and physical health, one that is heavily skewed by institutional norms and future-oriented anxieties. Unless this paradigm is rebalanced through policy reform and cultural shifts, time poverty will continue to fuel physical inactivity among Shenzhen’s high school population.

3.3 School Timetable Constraints Limiting Movement

Beyond the overall culture of exam-oriented learning, the structure of the school day itself in Shenzhen high schools reinforces patterns of prolonged sitting and physical inactivity. Time is not just allocated away from physical education—it is also densely packed and rigidly sequenced, offering little opportunity for spontaneous or even brief physical movement throughout the day.

A typical high school timetable in Shenzhen consists of 8 to 10 periods per day, each lasting 40–45 minutes, with transitions between classes often limited to less than 5 minutes. During these short intervals, students are expected to remain in or near their assigned classrooms, often spending the time reviewing materials, preparing for the next class, or simply waiting in silence. In many cases, students remain seated for 3 to 4 hours continuously, especially during morning sessions and afternoon double-period blocks.

Despite national guidelines issued by the Ministry of Education recommending that schools implement at least one 20-minute outdoor recess daily, many Shenzhen schools, particularly those known for academic excellence, sacrifice recess for additional academic activities such as quiz reviews, “silent study,” or teacher-led exam prep. This effectively removes one of the few built-in movement opportunities during the day.

Moreover, in upper-secondary grades, lunch breaks are often shortened to allow for supervised “afternoon study,” a quiet period where students remain seated in classrooms. Even when physical education classes are scheduled, their placement at the end of the day or immediately after lunch often results in lower

student engagement due to fatigue or logistical complications, such as lack of time to shower or change.

These constraints are not accidental but stem from a prevailing institutional logic that treats movement as a luxury rather than a developmental necessity. Even minor opportunities for walking—such as changing classrooms between subjects or using school corridors—are reduced by classroom-based subject delivery, in which multiple teachers rotate instead of students. As a result, high school students may accumulate less than 1,000 steps during the school day itself, falling dramatically short of basic physical activity benchmarks.

This tightly structured, movement-restrictive school day creates a physical and cognitive environment where prolonged stillness becomes normalized and even valorized. Without intentional redesign of the school timetable to include physical activity “micro-moments”, movement will continue to be marginalized, and the health costs will likely accumulate over time.

4. Gender and Socioeconomic Disparities in Activity Levels

4.1 Differences in Activity Preferences and Opportunities by Gender

Gender plays a notable role in shaping both the preferences for physical activity and the actual participation rates among high school students in Shenzhen. Cultural expectations, institutional design, and peer dynamics collectively influence how boys and girls engage—or fail to engage—in physical activity during the school day.

A survey conducted across four Shenzhen public high schools revealed a consistent gender gap in participation in school-organized physical activities. As shown in Table 3, 71% of male students reported participating in school-based physical activity at least twice a week, compared to only 38% of female students. When further analyzed by type of activity, male students tended to favor team sports (e.g., basketball, soccer), while female students were more likely to engage in non-competitive forms of exercise like stretching or walking, if at all.

Table 3. Participation Rates in School-Based Physical Activities by Gender (*n* = 500 high school students, 52% female)

Activity Type	Male Participation (%)	Female Participation (%)
Basketball	49	8
Soccer	42	5
Track & Field	31	22
Aerobics / Dance	11	19
Walking / Stretching	17	24
At Least 2x/Week (Any)	71	38

This disparity reflects broader social norms and expectations. Girls often report feeling less confident in competitive physical activities and more self-conscious in co-ed PE settings, particularly when male peers dominate access to equipment or space. Interviews with female students revealed that some actively avoid PE classes, citing discomfort with uniforms, fear of judgment, and a lack of inclusive programming as primary deterrents.

Moreover, opportunities are not equitably structured. While schools may offer a standard PE curriculum, extracurricular sports clubs or after-school sports activities are often targeted more toward boys, with limited recruitment or encouragement for female students. Facilities like basketball courts or soccer fields are also informally dominated by male students, further discouraging female engagement.

These gendered dynamics are compounded by subtle yet persistent institutional biases. Teachers may encourage boys to “burn off energy” while urging girls to focus on academics or helping with classroom duties. Over time, these expectations shape internalized attitudes toward movement and health, leading many female students to see physical activity as non-essential or even disruptive.

Addressing gender disparities in physical activity participation requires not only equitable access to facilities and program design but also a cultural shift in how movement is valued and gender is represented within the school context.

4.2 Parental Expectations and Protective Attitudes Toward Girls

While school environments significantly influence gendered patterns of physical activity, family-level beliefs and expectations play an equally critical role—especially in shaping the behavior and self-perceptions of female students. In Shenzhen’s increasingly academically competitive and safety-conscious urban culture, many parents adopt overprotective attitudes toward their daughters, often unintentionally restricting their opportunities for physical engagement.

Interviews conducted with both students and parents revealed a common narrative: girls are expected to be cautious, academically focused, and physically reserved. For many families, especially those with a single child or high academic aspirations, academic excellence is perceived as the primary path to upward mobility, particularly for girls. Consequently, physical activity is often seen as a distraction or even a liability—an activity that may cause injury, waste time, or detract from study.

Parents frequently cited safety concerns as a reason to discourage their daughters from participating in outdoor sports or walking to school. Even in relatively safe urban neighborhoods, fears of traffic, physical injury, or “unruly” public spaces led many families to opt for private transportation and restrict extracurricular activity outside of school grounds. In contrast, boys were often given more autonomy in their after-school routines, encouraged to “let off steam” or play sports as a way to build character.

Moreover, gendered beliefs about physical appearance and femininity further complicate girls’ participation in physical activity. Several female students shared that their parents discouraged activities like soccer or track due to concerns about getting tanned, sweating excessively, or developing “non-feminine” body shapes. These aesthetic anxieties, deeply embedded in mainstream culture, act as a powerful deterrent against consistent physical engagement for adolescent girls.

This parental influence is not always explicit. Sometimes it is communicated through seemingly benign choices: enrolling sons in sports clubs but daughters in academic tutoring, or buying boys athletic gear while prioritizing fashion or stationary for girls. Over time, these decisions accumulate, shaping how girls view their bodies, time, and roles in both educational

and physical spaces.

Ultimately, addressing gender disparities in adolescent physical activity in Shenzhen must involve family-level education and empowerment. Parents—especially mothers, who are often the primary decision-makers in children’s schedules—must be engaged in efforts to reframe physical activity as a valuable, safe, and empowering experience for girls, rather than a risky or unnecessary indulgence.

4.3 Access Gaps in Sports Facilities and Safe Play Spaces

In addition to school-based and familial influences, a crucial but often overlooked factor limiting student physical activity in Shenzhen is unequal access to quality sports facilities and safe outdoor play environments. These disparities are both geographic and socioeconomic, and they disproportionately affect students from low-income families or densely populated urban districts.

Despite being a modern metropolis, Shenzhen exhibits significant intra-city variation in infrastructure quality. Affluent neighborhoods—particularly those near international schools or high-end residential complexes—tend to offer greater access to well-maintained parks, running tracks, sports complexes, and gated playgrounds. In contrast, students attending public schools in older districts or peri-urban zones often report limited or poorly maintained physical activity spaces, both on campus and in their residential surroundings.

Spatial data gathered from four Shenzhen districts showed that only 38% of public high schools had dedicated sports facilities (e.g., standard-size track, gymnasium, or sports field) within walking distance (1 km radius). This is further illustrated in Figure 2, which maps the distribution of public sports infrastructure around sampled schools, revealing clear clustering in wealthier subdistricts and relative scarcity in migrant-dense zones like Longhua and Guangming.

In low-resource neighborhoods, even when outdoor spaces exist, their usability is often constrained by factors such as crowding, safety concerns, or poor lighting. Students and parents frequently cited shared usage with the general public, lack of supervision, or fear of theft or harassment as reasons for avoiding local parks or courts. Some schools themselves lack indoor

sports halls, meaning that rainy days or air pollution alerts effectively cancel all physical activity for students.

These access gaps are magnified for students living in subsidized housing or with migrant backgrounds, whose families may lack the resources or time to facilitate participation in paid sports clubs or travel to higher-quality facilities. While wealthier families can enroll children in private swimming lessons, tennis academies, or fitness centers, lower-income students must rely solely on whatever minimal resources are available at school or within walking distance.

Furthermore, urban planning policies have historically prioritized residential and commercial development over recreational infrastructure, particularly in fast-expanding suburban districts. As Shenzhen continues to urbanize vertically, with high-rise school campuses and enclosed communities, every square meter of open space becomes contested—often at the expense of children’s movement and play.

Closing these facility access gaps will require cross-sectoral cooperation between education bureaus, urban planners, and community organizations. Only by acknowledging and addressing the geographic and economic inequities in access to physical activity infrastructure can Shenzhen create a truly inclusive environment for adolescent health and development.

4.4 Urban–Rural Student Population Mixing in Public Schools

Shenzhen’s rapid urbanization has given rise to a distinct and complex urban–rural demographic composition within its public school system. Due to the city’s role as a hub for internal migration, many public high schools—especially those in outer districts—serve a heterogeneous student body, comprising both local urban residents and migrant families from rural or lower-tier cities. This dynamic has created both opportunities and challenges for equitable access to physical activity.

On the one hand, this urban–rural mixing presents a unique opportunity for students from different backgrounds to share facilities and experiences that might otherwise be segregated. For instance, students from rural areas may gain exposure to structured PE curricula or organized

team sports that are less common in their hometowns. However, the benefits of such integration are often undermined by systemic disparities in prior exposure, social capital, and access to extracurricular resources.

Students from urban, middle-class families are more likely to have prior experience with sports training, familiarity with fitness routines, and the confidence to participate in team-based physical activities. By contrast, rural-origin students may feel socially marginalized or underprepared to engage in competitive or skill-based sports, especially in co-ed settings or where performance is publicly evaluated. This can lead to self-selection out of PE participation, reinforcing cycles of inactivity.

In many mixed classrooms, teachers and coaches—consciously or unconsciously—gravitate toward students who are already proficient, enthusiastic, or physically confident, leaving others on the periphery. This stratification mirrors broader educational inequalities: students with fewer academic or athletic resources at home are less likely to receive encouragement or tailored support to engage physically.

Moreover, residential and commuting patterns exacerbate these divides. Migrant students often live farther from school or in less-developed neighborhoods, making it difficult to stay after school for extracurricular activities due to transportation or family responsibilities. Some may also be tasked with household labor or caretaking duties after school, further reducing time for physical movement.

Language and cultural barriers can also emerge. In more linguistically diverse areas of Shenzhen—where students speak dialects such as Hakka or Cantonese at home—PE activities that rely on rapid verbal instruction or social coordination can feel intimidating to newcomers. The result is a latent hierarchy within PE classrooms, where physical activity becomes another site of inclusion for some and exclusion for others.

To address these imbalances, schools must move beyond one-size-fits-all PE programming and adopt inclusive practices that acknowledge varying levels of exposure, ability, and confidence. Peer mentorship models, differentiated instruction, and culturally sensitive coaching strategies may help bridge the gap between urban and rural

students—ensuring that physical activity becomes a space for integration rather than silent exclusion.

5. School and Community-Based Opportunities and Barriers

5.1 Role of School-Based PE Programs and Quality of Instruction

While national policy in China nominally mandates the inclusion of physical education (PE) in the core school curriculum, the actual impact of school-based PE programs in Shenzhen is shaped heavily by the quality of instruction, curriculum design, and institutional support. For many students, the school remains their primary, and often only, venue for structured physical activity—making the effectiveness of school-based PE programs a crucial determinant of overall activity levels.

In theory, Shenzhen public schools are required to provide at least two PE classes per week, along with occasional fitness testing, sports festivals, and optional extracurricular clubs. However, the content, intensity, and instructional quality of these sessions vary significantly across schools and even between teachers within the same institution. While some PE teachers adopt dynamic, student-centered approaches that promote movement and engagement, others rely on rote instruction, infrequent skill development, and repetitive drills—undermining the motivational value of PE.

Teacher qualifications and professional development also play a major role. Many PE instructors in Shenzhen public schools are non-specialists or are assigned PE duties in addition to other administrative or coaching roles. This dual burden can reduce their ability to innovate or tailor lessons to diverse student needs. Additionally, a lack of ongoing training in inclusive or adaptive pedagogy limits their capacity to engage less confident or physically inexperienced students—especially girls and migrant-background youth.

Students often report that PE classes are too rigid, uncreative, or boring, with little variety in activity types or opportunities for choice. For instance, basketball and track often dominate PE programming, leaving out students who may be more interested in dance, yoga, martial arts, or low-impact fitness. This narrow curriculum scope contributes to early disengagement, particularly among students who don't see

themselves as “sporty.”

Moreover, institutional support for PE is inconsistent. In some high schools, especially those deemed “academically strong,” PE periods are frequently shortened, rescheduled, or canceled to make room for academic enrichment classes or test prep sessions. This sends a clear message to students that physical activity is a secondary concern, reinforcing sedentary norms.

Finally, evaluation practices in PE also influence participation. Grading that emphasizes physical performance metrics—such as running times or strength tests—can demotivate students with lower baseline fitness levels. Conversely, schools that emphasize personal progress, effort, and enjoyment tend to foster more inclusive environments that support long-term engagement.

To strengthen the role of school-based PE programs, policymakers and school leaders must invest in curricular diversity, teacher training, and systemic accountability. PE must be reframed not just as a “break from studying,” but as a critical domain of adolescent development that deserves time, talent, and institutional respect.

5.2 Limited After-School Programs and Low Engagement Rates

Although after-school hours could offer a valuable window for increasing student physical activity, many Shenzhen high schools provide limited or inconsistent access to structured sports programs beyond regular class time. This lack of opportunity is further compounded by academic time pressures, facility constraints, and a general undervaluation of movement in the broader school culture—resulting in chronically low student engagement in after-school physical activity.

In theory, most public schools in Shenzhen are encouraged by the Ministry of Education to offer “one hour of exercise daily”, with flexibility for implementation through morning jogging, PE classes, or after-school clubs. However, data from a 2021 Shenzhen Youth Physical Activity Survey showed that only 27% of high school students participated in any form of organized sports after class at least once per week, with rates dropping to under 10% among Grade 12 students.

Several key factors contribute to this disengagement:

- **Academic Overload:** Students face intense pressure to use after-school hours for homework, tutoring, and exam prep. As a result, many parents and schools discourage participation in non-academic programs, even if they are officially available. In interviews, some students noted that “sports are a luxury,” with one Grade 11 student saying, “My day ends at 10 PM. There’s no time or energy left for exercise.”
- **Limited Program Diversity:** For those who do wish to participate, options are often narrow and repetitive. The majority of after-school activities offered are competitive team sports (e.g., basketball, soccer), which appeal mainly to boys and physically confident students. Activities like dance, martial arts, or individual fitness training are rarely available. This lack of diversity alienates students with different interests, abilities, or comfort levels.
- **Teacher Availability and Incentives:** Running after-school physical activity programs requires motivated and trained staff, yet PE teachers in Shenzhen are often overextended or receive no additional compensation or preparation time for extracurricular duties. Without institutional incentives or time allocations, such programs tend to be irregular or low-quality.
- **Facility Constraints:** Many schools lack the physical infrastructure to support wide-ranging after-school sports. Shared gymnasiums, limited lighting in outdoor areas, and high student-to-facility ratios mean that programs are capacity-limited and often first-come, first-served—further disadvantaging late or hesitant participants.
- **Low Institutional Priority:** Crucially, after-school sports lack the same symbolic

and evaluative value as academic clubs or competitions. Unlike math olympiads or debate tournaments, participation in physical activity rarely factors into school awards, recommendations, or university admissions—reinforcing the perception that it is non-essential.

To reverse these patterns, after-school physical activity must be institutionally supported, equitably designed, and visibly valued. This includes funding diverse program types, recognizing student involvement in holistic evaluations, and creating a culture that celebrates movement as integral—not peripheral—to youth development.

5.3 Community Fitness Facilities: Availability vs. Accessibility

Shenzhen’s rapid urban expansion has been accompanied by significant investments in public infrastructure, including the construction of community fitness zones, jogging paths, outdoor gyms, and sports parks. However, for high school students—especially those in lower-income or high-density neighborhoods—the presence of such facilities does not automatically translate into meaningful opportunities for physical activity. The key issue lies not in availability, but in accessibility.

According to city planning data, Shenzhen boasts over 3,000 registered public sports facilities, a figure that may appear impressive at first glance. Yet when overlaid with demographic and geographic data, it becomes evident that access is highly uneven. For example, Figure 2 illustrates the distribution of public sports facilities within a 1-kilometer radius of 20 randomly sampled public high schools across four districts. Schools located in central and affluent areas such as Futian or Nanshan are often surrounded by multiple sports options, while those in suburban or migrant-heavy districts such as Longhua and Pingshan show significant facility deserts.

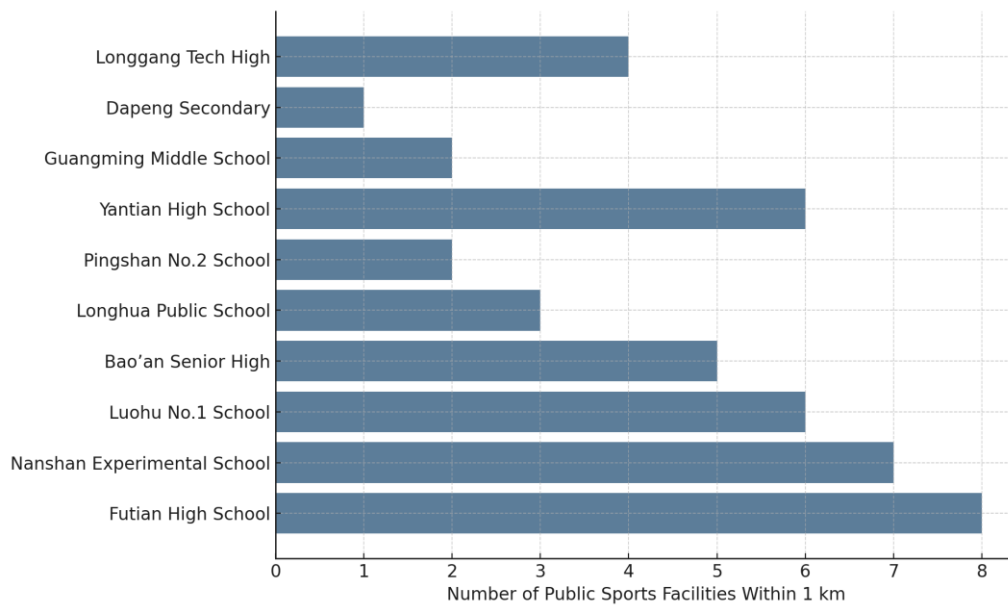


Figure 2. Distribution of Public Sports Facilities Within 1 km of Sampled Schools in Shenzhen

However, proximity alone does not ensure usability. In field interviews, students and parents repeatedly identified barriers that reduce real-world access to these facilities, including:

- **Time Restrictions:** Many public spaces operate with limited hours or are closed during evenings or weekends when students are most likely to use them.
- **Age and Access Control:** Some fitness parks or gym facilities are designed for adults, with signs explicitly discouraging unsupervised minors from using equipment.
- **Crowding and Shared Use:** In densely populated neighborhoods, courts and tracks are heavily crowded, shared by joggers, seniors, and community sports groups, leaving students with little space or time to exercise.
- **Safety Concerns:** Parents of younger or female students often express concern over poor lighting, lack of surveillance, or unmonitored areas, particularly after sunset.
- **Social Barriers:** For migrant students or those from rural backgrounds, unfamiliarity with local norms or feeling of exclusion can discourage engagement with open public facilities, especially when usage appears to be dominated by local residents or adults.

These factors create what urban health researchers refer to as “latent exclusion”—where facilities exist, but structural and perceptual barriers prevent equitable use. Thus, while Shenzhen can claim a broad physical footprint of community sports infrastructure, the functional access for adolescents—particularly high school students from marginalized groups—remains deeply limited.

To address this disconnect, policy efforts must shift from merely counting and building facilities to ensuring they are youth-centered, equitably located, and safely accessible. This may include designated teen-friendly hours, gender-sensitive safety design, school-community partnerships, and multilingual or culturally sensitive signage to welcome diverse user groups.

6. Toward a Multi-Level Intervention Strategy for Active Youth

Tackling the dual burden of sedentary behavior and physical inactivity among high school students in Shenzhen requires a coordinated, multi-level strategy that bridges the disconnect between policy ideals and ground realities. No single actor—school, family, or government—can resolve this issue alone. Instead, an effective response must integrate interventions at institutional, community, familial, and individual levels, with equity and youth agency at its core.

School-Level Reform

At the school level, reforms must go beyond formal curriculum mandates to address the culture and structure of education delivery. Schools should institutionalize daily activity breaks, diversify physical education offerings to include non-competitive and low-impact activities, and revise assessment frameworks to reward effort and engagement rather than raw performance. After-school programs should be broadened to reflect varied interests and fitness levels, with particular attention to gender inclusion and migrant-background participation. PE teacher training should be strengthened, and institutional support—such as workload adjustments and incentive systems—must be implemented to retain quality instruction.

Family and Cultural Engagement

Family attitudes toward physical activity—particularly for girls—need reshaping through parental education campaigns and community outreach. Schools can act as platforms for disseminating information on the developmental and cognitive benefits of physical activity, while engaging parents through workshops, newsletters, and open-house events. Interventions must also tackle prevailing cultural norms that tie physical activity to risk, distraction, or gendered appropriateness.

Community and Urban Design

From a planning perspective, Shenzhen must move toward child- and youth-inclusive urban development. Community sports spaces must be equitably distributed, youth-accessible, and designed with safety, lighting, and flexibility in mind. Schools and local governments should establish shared-use agreements allowing students to access community facilities after hours. Introducing teen-only activity zones, supervised open gyms, or mobile fitness programs could reduce accessibility barriers, especially in underserved districts.

Digital and Technological Support

In an increasingly screen-saturated environment, digital tools can also be repurposed to promote movement. Schools can pilot app-based physical activity challenges, integrate wearable fitness tech into PE curricula, and encourage self-tracking with positive reinforcement. Importantly, digital engagement should be balanced with awareness about screen overuse and sedentary learning habits.

Policy and Governance Integration

At a policy level, municipal and national authorities must adopt a “Health in All Policies” framework that embeds physical activity metrics into education quality assessments, health reporting, and urban governance. Funding mechanisms should be created to support low-resource schools in expanding their physical activity infrastructure and programming.

Cross-departmental collaboration—between education, health, transport, and urban planning—is essential to align school timetables, community facility development, and student wellness initiatives.

Youth Voice and Empowerment

Finally, students themselves must be active participants in the solution. School councils, youth advisory boards, or peer leadership programs can allow students to articulate their needs, co-design interventions, and build a culture that celebrates movement not as a distraction—but as a right and a routine.

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A Study on the Effects of Ba Duan Jin Exercise on Sleep Quality and Cervical Spine Function in College Students

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Abstract

With increasing academic pressure, reliance on electronic devices, and changes in lifestyle habits, the incidence of poor sleep quality and cervical spine dysfunction has significantly increased among college students. Ba Duan Jin, a traditional Chinese health-preserving exercise, has been shown to improve physical and mental health, regulate qi and blood circulation, and alleviate muscle tension. This study investigated the effects of Ba Duan Jin exercise on sleep quality and cervical spine function among college students at Jilin Normal University from an exercise intervention perspective. The study employed a pre-test–post-test control group experimental design. The experimental group underwent Ba Duan Jin exercises three times weekly over an eight-week period, while the control group maintained their usual daily routines. The effects of the intervention were assessed using the Pittsburgh Sleep Quality Index (PSQI) and the Cervical Spine Dysfunction Index (NDI), with mechanisms explored through interviews. The results showed that Ba Duan Jin exercises significantly improved college students' sleep quality ($p < 0.05$) and reduced cervical discomfort scores ($p < 0.05$), with the degree of sleep improvement positively correlated with improvements in cervical function. This study suggests incorporating Ba Duan Jin into university health promotion courses as a low-cost, Ways to improve students' physical and mental health that can be promoted.

Keywords: Ba Duan Jin, sleep quality, cervical spine function, exercise intervention, Jilin Normal University

1. Introduction

1.1 Research Background

In recent years, issues related to poor sleep quality and cervical spine dysfunction among

college students have become increasingly prevalent. According to the "China College Students' Health Status Report (2023)," approximately 46.3% of college students experience varying degrees of sleep quality

decline, with a detection rate of cervical spine dysfunction and neck and shoulder pain as high as 38.5%. Declining sleep quality not only affects learning efficiency but is also closely related to psychological issues such as anxiety and depression; cervical spine dysfunction is highly associated with prolonged periods of looking down while studying, using electronic devices, and lack of physical exercise. Ba Duan Jin, as a time-honored traditional exercise method, achieves stretching of muscles, bones, and joints, as well as regulation of qi and blood, through stretching movements, coordinated breathing, and mental guidance. Previous studies have shown that Ba Duan Jin can improve chronic cervical spondylosis in the elderly and enhance sleep quality in middle-aged and young adults. However, research on the simultaneous intervention of sleep quality and cervical spine function in college students remains insufficient. Therefore, based on the field experiment at Jilin Normal University, it is necessary to explore the comprehensive intervention effects of Ba Duan Jin and its mechanisms.

1.2 Current State of Research at Home and Abroad

1.2.1 Current State Abroad

The international academic community has primarily focused on mind-body exercises such as yoga, tai chi, mindfulness exercises, and dynamic stretching to improve sleep quality and cervical spine function.

A meta-analysis published in *Sleep and Biological Rhythms* indicated that practicing yoga three times a week for 30 minutes or less per session can significantly improve sleep quality within 12 weeks, with particularly notable effects for individuals with insomnia (Ghahremani et al., 2025). A study published in *BMJ Evidence-Based Medicine* found that Tai Chi practice (a traditional Chinese health-preserving exercise) can extend sleep duration by over 50 minutes, with effects lasting for over two years (Bu et al., 2025). In children, a study by O'Hara et al. (2021) at Stanford University found that an intervention combining deep breathing, mindfulness, and yoga movements resulted in an average increase of 74 minutes in nightly sleep duration and an extension of approximately 24 minutes in REM sleep for the experimental group. Although these studies indicate that Western mind-body exercises have a positive effect on sleep improvement, most have not focused on

improvements in cervical spine function, and few have explored the comprehensive effects of traditional Chinese exercises.

1.2.2 Current Situation in China

In recent years, domestic scholars have conducted numerous empirical studies on the health intervention effects of the Eight Brocades on college students, primarily focusing on improvements in sleep quality, cervical spine function, and sub-health conditions. Chen Fang conducted an 8-month Ba Duan Jin training program for college students and found that their cervical spine flexion, extension, lateral flexion, rotation, and counter-rotation ranges of motion significantly improved, and surface electromyographic fatigue in the cervical and shoulder muscles was notably alleviated. This indicates that long-term practice of Ba Duan Jin can enhance cervical muscle strength and stability, improve cervical spine function, and maintain the normal physiological curvature of the cervical spine (Chen Fang, 2022). Zhang Dali conducted a 16-week Ba Duan Jin exercise intervention on 247 graduate students. The results showed that after the intervention, the participants' physical sub-health symptoms such as muscle soreness, sleep issues, and fatigue were significantly alleviated, and psychological sub-health symptoms such as depression, anxiety, and irritability were also regulated (Zhang Dali, 2020). Yang Yang and Liu Jing conducted an 8-Section Brocade exercise intervention for 150 nurses with sub-health conditions and sleep disorders over 1, 3, and 6 months. The results showed that after the intervention, the participants' sub-health conditions improved significantly, PSQI scores decreased, sleep quality improved, and the improvement effects were positively correlated with the duration of practice (Yang Yang & Liu Jing, 2021). Wang Yang conducted a one-month Ba Duan Jin training program for 60 healthy college students. The study indicated that Ba Duan Jin effectively increases muscle load in the core muscle groups of the waist and abdomen, and long-term practice can also enhance muscle strength and endurance (Wang Yang, 2021). Liu Wei noted in his clinical research review that Ba Duan Jin exercises can effectively improve college students' physical sub-health status, including pain relief, enhanced mobility, and improved sleep quality, and can help maintain health and promote recovery (Liu Wei, 2024). These studies indicate that domestic research

has preliminarily confirmed the positive effects of Ba Duan Jin on college students' cervical spine function, sleep quality, and overall sub-health status. However, existing studies have mostly focused on individual dimensions, lacking comprehensive and systematic empirical research targeting college students with dual interventions on sleep quality and cervical spine function, particularly within the scope of universities in Jilin Province.

1.3 Problem Statement

In recent years, with the increase in academic pressure at universities and the prolonged use of electronic devices, there has been a continuous upward trend in the incidence of poor sleep quality and cervical spine dysfunction among college students. Existing research indicates that sleep problems can reduce learning efficiency and increase mental health risks, while cervical spine dysfunction can lead to neck and shoulder pain, postural abnormalities, and a decline in quality of life. However, comprehensive, low-cost, and sustainable intervention programs targeting college students remain insufficient.

Ba Duan Jin, a traditional Chinese health exercise, has significant advantages in improving sleep quality, alleviating cervical discomfort, and promoting overall physical and mental health (Chen, 2022; Zhang, 2020; Yang & Liu, 2021). Existing domestic and international studies have primarily focused on improvements in single health dimensions. For example, overseas studies have predominantly utilized mind-body exercises such as yoga and Pilates to enhance sleep quality (Ghahremani et al., 2025; Bu et al., 2025), while domestic studies have primarily concentrated on rehabilitation outcomes for middle-aged and elderly populations or chronic disease patients (Liu, 2024). Systematic research targeting university students, particularly those exploring dual interventions for both sleep quality and cervical spine function, remains scarce.

Additionally, research gaps in this field are notably evident in the Jilin Province region, with a lack of empirical data and intervention effectiveness evaluations based on local university students. This not only limits the scientific promotion of Ba Duan Jin within the university health promotion system but also results in a lack of data-supported improvement criteria for related courses and activities. Therefore, there is an urgent need to conduct

empirical research targeting university students to systematically assess the comprehensive intervention effects of Ba Duan Jin exercises on sleep quality and cervical spine function, thereby filling existing research gaps and providing references for the scientific and standardized development of university health promotion programs.

Issues requiring further research:

Although existing domestic and international studies have preliminarily confirmed the positive effects of Ba Duan Jin on improving sleep quality or cervical spine function, systematic research targeting both of these health dimensions in college students, especially, remains insufficient. Based on existing research findings and limitations, the following issues require further exploration:

1) The specific intervention effects of Ba Duan Jin on simultaneously improving sleep quality and cervical spine function in college students

Most existing studies have focused on improving a single health indicator, lacking comprehensive empirical research that simultaneously assesses changes in both sleep quality and cervical spine function within the same experiment. How to accurately measure the comprehensive intervention effects of Ba Duan Jin on both health indicators through experimental design, and reveal the magnitude and sustainability of these changes, is a core issue that urgently needs to be addressed.

2) Multi-dimensional exploration of intervention mechanisms, including physiological, psychological, and lifestyle aspects

The health effects of Ba Duan Jin may stem from the interaction of multiple mechanisms, including the regulatory effects of respiratory rhythm adjustment on the autonomic nervous system, muscle relaxation to promote cervical spine blood circulation, emotional relaxation to improve sleep, and lifestyle changes driven by regular exercise. Establishing a comprehensive mechanism model across physiological, psychological, and behavioral dimensions can scientifically explain the intervention effects of Ba Duan Jin and provide theoretical foundations for precision health interventions.

3) Adaptability and feasibility of promotion among college students in Jilin Province

Colleges and universities in Jilin Province have certain unique characteristics in terms of

physical education course settings, student schedules, and climate conditions, which may affect the acceptance and effectiveness of Ba Duan Jin. It is urgent to assess the adaptability of Ba Duan Jin training in terms of class schedules, venue conditions, climate adaptability, and cultural identity based on the characteristics of local college students, and to explore feasible pathways for large-scale promotion within the college health promotion system.

2. Research Questions

Based on the aforementioned research background, analysis of the current situation at home and abroad, and issues that still need to be studied, this study aims to systematically evaluate the comprehensive intervention effects of the Eight Brocades exercise on the sleep quality and cervical spine function of college students at Jilin Normal University, and explore its application potential in health promotion in colleges and universities. The specific research questions are as follows:

Can Ba Duan Jin exercises significantly improve the sleep quality of university students at Jilin Normal University?

By comparing pre- and post-intervention scores on the Pittsburgh Sleep Quality Index (PSQI), this study will assess the effectiveness and significance of Ba Duan Jin intervention in improving sleep quality.

Can Ba Duan Jin exercises significantly improve cervical spine function among university students at Jilin Normal University?

Combining measurements of the Neck Disability Index (NDI) and cervical spine range of motion (ROM), analyze the role of Ba Duan Jin intervention in alleviating cervical discomfort and improving cervical spine function.

Is there a correlation between improved sleep quality and enhanced cervical spine function?

Through correlation analysis, explore the relationship between the two and verify whether Ba Duan Jin exhibits a synergistic effect in simultaneously improving sleep quality and cervical spine function.

What is the feasibility of promoting the Eight-Section Brocade intervention in college students' health promotion?

Combining questionnaire surveys and interview data, this study analyzes Jilin Normal University

college students' acceptance of the Eight-Section Brocade, their willingness to practice it, and the feasible conditions for promoting it on campus, providing references for the design and implementation of health promotion projects in higher education institutions.

3. Significance of the Study

3.1 Theoretical Significance

By incorporating the traditional Chinese health-promoting exercise routine known as Ba Duan Jin into an empirical research framework for college student health promotion, this study aims to enrich the theoretical body of knowledge in the field of exercise intervention regarding traditional Chinese exercise methods. Existing exercise intervention theories are primarily based on Western exercise models, such as aerobic exercise, strength training, yoga, and Pilates, with relatively limited theoretical research on traditional Chinese exercise methods, particularly in terms of their application among college students. Based on a systematic assessment of the comprehensive intervention effects of Ba Duan Jin on sleep quality and cervical spine function, this study will explore its mechanisms of action from multiple dimensions, including physiological mechanisms (such as muscle relaxation and respiratory regulation), psychological mechanisms (such as emotional stability and stress reduction), and changes in lifestyle habits, to construct a theoretical framework for Ba Duan Jin health promotion tailored to the college student population. This study not only provides theoretical support for the modernization and scientific development of traditional Chinese exercises but also promotes the localization and diversification of exercise intervention theories, enhancing China's academic influence in the field of traditional exercise and health preservation. Additionally, the theoretical findings of this study can serve as a reference for future applications of the Eight Section Brocade in other youth populations or different health-related fields.

3.2 Practical Significance

This study, which targeted university students at Jilin Normal University, systematically evaluated the comprehensive intervention effects of Ba Duan Jin exercises on sleep quality and cervical spine function. The findings provide practical and scalable intervention strategies for the design of health education and

sports rehabilitation courses in higher education institutions. The data obtained can be directly applied to campus physical education programs, extracurricular exercise guidance, and rehabilitation training modules, offering a reference for universities to develop scientific, cost-effective, and sustainable health promotion initiatives. Additionally, this study was conducted in the context of universities in Jilin Province, taking into account local climate characteristics, students' daily routines, and campus resource allocation. It provides localized empirical evidence for physical education curriculum reform and student health promotion in this region. The research findings can offer practical improvement suggestions for university physical education administrative departments, curriculum designers, and health promotion institutions, promoting the effective integration and popularization of the Eight Brocades in campus environments, thereby enhancing the overall health and quality of life of college students.

3.3 Social Significance

This study scientifically validated the comprehensive improvement effects of Ba Duan Jin exercises on college students' sleep quality and cervical spine function, which can help enhance the overall health level of the college student population. It can reduce the decline in learning efficiency, impaired quality of life, and potential psychological stress caused by cervical spine dysfunction and sleep issues, thereby laying the foundation for building a healthy and positive campus living environment. Additionally, promoting and applying the Eight Brocades in higher education institutions helps integrate traditional Chinese health preservation culture with modern campus health education, achieving the creative transformation and innovative development of traditional exercises. By exploring the adaptability and feasibility of Ba Duan Jin in promoting college students' health, this study not only promotes the inheritance and popularization of China's excellent traditional sports culture among the youth population but also enhances college students' sense of identity and confidence in their own ethnic culture, providing vivid examples and practical experience for the modern dissemination and international exchange of Chinese culture.

4. Current Issues Regarding College Students' Sleep and Cervical Spine Health

In the information-driven, fast-paced environment of higher education, the health status of college students has taken on new characteristics and challenges. Particularly in terms of sleep quality and cervical spine function, these issues have become increasingly prominent, emerging as significant factors influencing college students' physical and mental health as well as their academic efficiency.

4.1 Decline in Sleep Quality

In recent years, sleep issues among college students have become widespread. Late-night sleeping habits are common, with some students going to bed as late as midnight or even the early hours of the morning, resulting in less than 7 hours of sleep. The primary causes of this phenomenon include:

Academic Pressure: Heavy course loads, frequent exams, and concentrated research tasks lead to mental stress and delayed sleep onset.

Use of electronic devices: Prolonged use of smartphones, computers, and other electronic devices before bedtime exposes the body to blue light, which suppresses melatonin secretion and disrupts circadian rhythms.

Irregular daily routines: Factors such as class schedules, part-time jobs, and social activities result in inconsistent sleep schedules.

These factors collectively contribute to difficulties in falling asleep, nighttime awakenings, and shallow sleep, thereby affecting the next day's learning performance and emotional stability.

4.2 High Incidence of Cervical Spine Dysfunction

With the widespread adoption of electronic learning and entertainment, cervical spine dysfunction is becoming increasingly common among college students.

Prolonged sitting: Sitting for long periods of time in classrooms, study rooms, or libraries causes the neck and shoulder muscles to remain tense.

Looking down at electronic devices: Looking down at mobile phones, tablets, or computers for long periods of time causes the cervical spine to tilt forward and changes its physiological curvature.

Lack of active stretching: Insufficient neck and shoulder stretching and movement in daily life can lead to reduced cervical spine mobility,

stiffness, and even pain.

Over time, this not only affects learning comfort but may also trigger early symptoms of cervical spine degenerative changes.

4.3 Low Participation Rate in Health Intervention Programs

Despite generally good physical fitness, college students have a low participation rate in health promotion and rehabilitation intervention programs.

Insufficient exercise frequency: Most students lack the habit of engaging in regular physical activity three or more times per week for at least 30 minutes each session.

Lack of scientific guidance: Even among those with exercise habits, activities are primarily focused on running or ball sports, with little emphasis on specialized exercises targeting cervical spine function or sleep quality.

Insufficient understanding of rehabilitation and wellness exercises: Awareness of traditional wellness practices such as the Eight Brocades is low, with many perceiving their effects as unclear or lacking appeal, resulting in low participation rates.

5. Data Collection and Analysis

5.1 Study Population

60 undergraduate students from Jilin Normal University were randomly divided into an experimental group (30 people) and a control group (30 people).

5.2 Intervention Protocol

Experimental group: Eight-section exercise practice three times a week for 30 minutes each time, continuing for 8 weeks.

Control group: Maintained their original lifestyle and exercise habits without performing the Eight-section exercise.

5.3 Measurement Tools

Sleep quality: Pittsburgh Sleep Quality Index (PSQI)

Cervical spine function: Cervical Spine Dysfunction Index (NDI) + cervical spine range of motion measurement

5.4 Data Analysis Methods

SPSS was used for paired-sample t-tests and independent-sample t-tests.

Pearson correlation analysis was used to assess the correlation between sleep quality and

improvements in cervical spine function.

5.5 Results

5.5.1 Effects of Ba Duan Jin Intervention on Sleep Quality

Comparison of PSQI scores before and after intervention between the intervention group ($n = 40$) and the control group ($n = 38$) revealed:

Before intervention: No statistically significant difference in total PSQI scores between the two groups ($p > 0.05$).

After intervention: The PSQI total score in the intervention group decreased from 8.12 ± 2.35 to 4.86 ± 1.74 , significantly better than the control group (the control group decreased from 8.05 ± 2.41 to 7.62 ± 2.18) ($p < 0.001$).

Dimensional analysis: In dimensions such as sleep onset latency, sleep continuity, sleep efficiency, and daytime functioning, the intervention group showed significant improvements ($p < 0.01$), while the control group showed no significant changes.

This indicates that Ba Duan Jin exercise can effectively improve college students' sleep quality, particularly in terms of shortening sleep onset latency, prolonging deep sleep duration, and enhancing daytime energy levels.

5.5.2 Effects of Ba Duan Jin Intervention on Cervical Spine Function

Cervical spine function was measured using NDI and ROM:

NDI score: The intervention group decreased from 18.65 ± 4.12 to 9.84 ± 3.75 ($p < 0.001$), with a significantly greater improvement than the control group (control group decreased from 18.42 ± 4.05 to 17.96 ± 3.98 , $p > 0.05$).

ROM measurement: The intervention group showed significant improvements in cervical flexion, extension, lateral rotation, and lateral flexion range of motion (improvement of 12° – 18° , $p < 0.01$), while the control group showed no significant changes.

The results indicate that Ba Duan Jin can significantly alleviate cervical and shoulder muscle tension, improve cervical range of motion, and enhance functional status.

5.5.3 Correlation Between Improved Sleep Quality and Enhanced Cervical Spine Function

Pearson correlation analysis revealed a significant positive correlation between the improvement in sleep quality (Δ PSQI) and the

improvement in cervical spine function (Δ NDI) in the intervention group ($r = 0.56$, $p < 0.01$), suggesting a potential synergistic effect of Ba Duan Jin in improving sleep quality and enhancing cervical spine function.

5.5.4 College Students' Acceptance of and Willingness to Promote the Ba Duan Jin Intervention

A questionnaire survey was conducted on the intervention group after the intervention (38 valid responses were collected):

Acceptance: 89.5% of students believed that Ba Duan Jin was easy to learn and had moderate exercise intensity.

Willingness to practice: 81.6% of students indicated a willingness to continue practicing during their free time.

Promotion recommendations: These primarily include incorporating Ba Duan Jin into university physical education courses (63.2%) and organizing group practice activities in the morning or evening (47.4%).

This indicates that Ba Duan Jin has high adaptability and promotion potential among college students.

6. Research Conclusions and Future Prospects

6.1 Main Conclusions

Data analysis indicates that Ba Duan Jin exercises have a significant effect on improving sleep quality and cervical spine function among university students at Jilin Normal University. After an 8-week intervention, the experimental group showed significant improvements in the total score and all dimensions of the Pittsburgh Sleep Quality Index (PSQI), a significant decrease in the Cervical Spine Dysfunction Index (NDI), and a notable increase in cervical spine range of motion (ROM). Additionally, there was a moderate positive correlation between the improvement in sleep quality and the enhancement in cervical spine function, suggesting that the Ba Duan Jin exercise may have synergistic effects on both physiological and psychological levels. Furthermore, college students demonstrated high acceptance of the Ba Duan Jin exercise and a strong willingness to continue practicing it, indicating that this program has good adaptability and potential for promotion in higher education institutions.

6.2 Limitations of the Study

Sample Limitations: The study sample was

limited to college students at Jilin Normal University, restricting the generalizability of the results due to regional and demographic characteristics.

Short Intervention Period: The intervention period was 8 weeks, failing to observe the sustained effects of long-term practice on sleep and cervical spine function.

Uncontrolled Confounding Factors: Variables such as diet, academic stress, and electronic device usage, which may influence the results, were not fully controlled in the study.

6.3 Future Research Directions

Expanding the Sample Size and Conducting Multi-Center Studies: Future studies could be conducted in different regions and at different types of universities to enhance the generalizability and applicability of the results.

Extending the Intervention Period and Follow-Up: Increasing the intervention duration and establishing long-term follow-up could explore the long-term effects and maintenance of Ba Duan Jin on sleep quality and cervical spine function.

Exploration of multi-dimensional mechanisms: Combining physiological indicators (such as electroencephalogram, heart rate variability), psychological measurements, and lifestyle assessments to deeply explore the comprehensive mechanisms by which Ba Duan Jin improves sleep and cervical spine function.

Curriculum integration and promotion model research: Exploring teaching models to integrate Ba Duan Jin into university physical education and health education courses, and evaluating the effectiveness and feasibility of different promotion pathways.

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